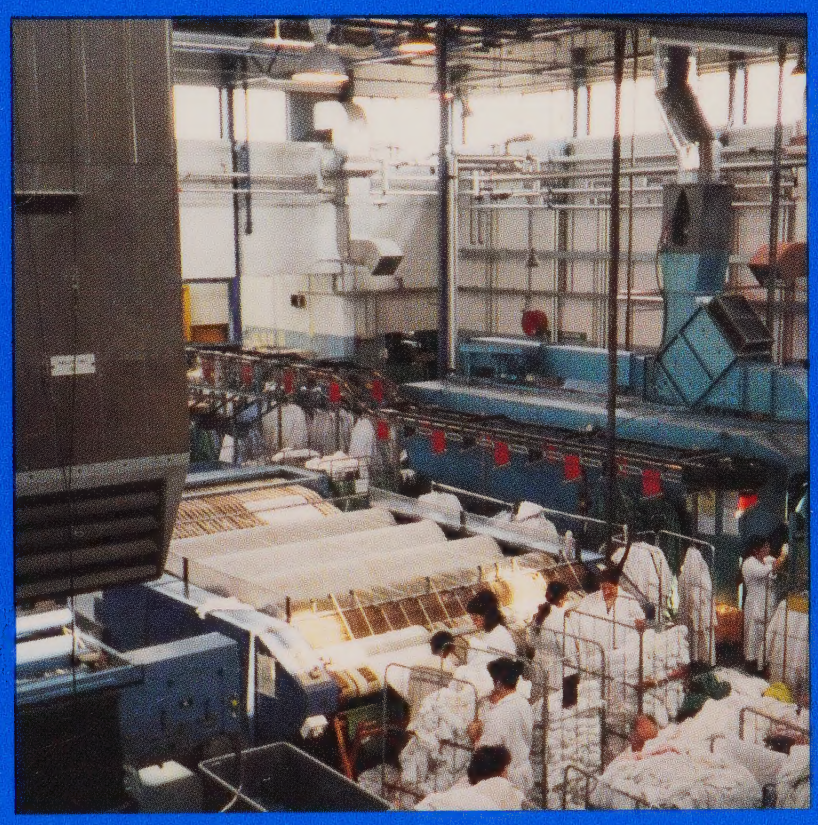
MC0119

Health Building Note 25

Laundry



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Health Building Note 25

Laundry

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About this publication

The Health Building Note series is intended to give advice on the briefing and design implications of Departmental policy.

These Notes are prepared in consultation with representatives of the National Health Service and appropriate professional bodies.

Health Building Notes are aimed at multidisciplinary teams engaged in:

- designing new buildings;
- adapting or extending existing buildings.

Throughout the series, particular attention is paid to the relationship between the design of a given department and its subsequent management. Since this equation will have important implications for capital and running costs, alternative solutions are sometimes proposed. The intention is to give the reader informed guidance on which to base design decisions.

Health Building Note 25

HBN 25 focuses on NHS Laundry, with accommodation requirements for:

- production area;
- offices and accommodation;
- stores and supplies;
- plantrooms.

Acknowledgements

NHS is grateful to the Society of Hospital Linen Service and Laundry Managers for their contribution to the development of this guidance.

Photographs

D A Mondry Blaszczyk Dip Arch (Hons) RIBA
Laundry at Swindon

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1.0 Scope of Health Building Note 25

1.1 This Health Building Note (HBN) provides guidance on the design of a laundry on a hospital site; it can also be used as guidance when designing an offsite laundry. It replaces HBN 25, originally issued in 1964 and revised in 1977. The Note reflects the latest developments in laundry equipment and layout. The guidance will be useful not only in the planning of a new laundry but also in the rationalisation and upgrading of existing facilities. It is not, however, intended to be applied retrospectively to existing stock.

Inclusions

1.2 The guidance contained in this Note can be used in the design of laundries required to process 55,000–200,000 articles per week. Information relating to laundry plant, disinfection requirements, spaces and dry-cleaning needs is included. It takes into account advice on laundry procedures for the treatment of used and infected linen outline in HC(87)30 (in Wales WHC(88)4).

1.3 Guidance is included for the provision, where required, of special laundering facilities for those items of patients' personal clothing which are unsuitable for bulk or semi-bulk processing.

1.4 Storage facilities for soiled and/or clean linen may be needed at sending hospitals and this Note includes recommendations on an appropriate scale of provision.

Exclusions

1.5 This Note does not include guidance on:

a. laundrettes and other stand-alone washing machines – if these are provided it is recommended that commercial-type machines are installed in preference to domestic appliances;

b. types of vehicles required for collection and delivery services between laundries and users.

Works Guidance Index

1.6 This volume contains guidance that is current at the time of publication. Specific issues such as arrangements for dealing with fire, security, energy conservation and Health and Safety, are covered by other published guidance which must also be taken into account. Some aspects of the guidance in this volume may from time to time be amended or qualified. Project teams should check the current edition of the Works Guidance Index. Because the Index is published by NHS Estates in May each year, and updated in September and January, project teams should ensure that they investigate the possibility of changes occurring after the latest published Index.

Cost allowances

1.7 The NHS is notified separately of the Departmental cost allowance for this Note.

Capricode

1.8 Capricode is the mandatory procedural framework governing the inception, planning, processing and control of individual health building schemes. The aim is to promote a consistent and streamlined approach to capital development that achieves the best use of resources through the selection and construction of relevant and cost-effective schemes that open on time and within budget. It identifies the main activities and provides a framework for delegation with effective management and the proper accounting for expenditure and performance (see 'Capricode Health Building Procedures' issued with HBN(86)32 (in Wales, WHC(86)62).

1.9 Equipment is categorised into four groups, as follows:

Group 1: items (including engineering terminal outlets) supplied and fixed within the terms of the building contract;

Group 2: items which have space and/or building construction and/or engineering service requirements and are fixed within the terms of the building contract but supplied under arrangements separate from the building contract;

Group 3: as Group 2, but supplied and fixed (or placed in position) under arrangements separate from the building contract;

Group 4: items supplied under arrangements separate from the building contract, possibly with storage implications but otherwise have no effect on space or engineering service requirements.

Group 1 items are provided for in the cost allowance associated with this volume. The Equipment Cost Allowance Guide (ECAG) specifies a sum of money for the functional unit for Groups 2, 3 and 4.

2.0 General service considerations

Functions of the service

2.1 The accommodation described in this Note provides facilities for:

a. cleansing by the use of thermal disinfection washing processes of all used and infected linen and other garments used in hospitals or health service activities;

b. drying and finishing of articles at the lowest cost consistent with a standard of finish acceptable for their use and within a time span which meets particular needs of user departments;

c. other functions of linen services department, which are: central linen exchange, marking, repair, disposal of condemned linen and technical advice to customers.

2.2 In some instances functions will incorporate special facilities for the laundering of personal clothing belonging to long-stay patients and other health service users. This will include heat labile and other such small articles which cannot be properly processed in bulk processing machines.

2.3 There may also be a requirement for the dry cleaning of garments and furnishings.

Initial planning considerations

2.4 Provision of a new laundry or the major upgrading of an existing one entails considerable investment. Revenue expenditure over the life of the project will be in the order of 20 times the capital cost. It is essential, therefore, that at an early stage in the planning the project team should consider rationalisation of laundry services across a region, or the possibility of obtaining laundry services from an adjoining district. An operational policy for the laundry should be agreed with all disciplines before planning commences, and the design should lead to:

a. the most economic solution in terms of total cost;

b. good management practices free from operational problems;

c. the laundering of linen on a scale most likely to maximise the cost benefits of large-capacity labour-saving processing plant.

2.5 An investment appraisal of total costs, capital and revenue will always be necessary when considering whether it is worth investing in new buildings, plant and equipment. This exercise will also indicate the appropriate timing of any new investment.

2.6 Because planners now have a choice of a wide range of washing systems, energy-saving equipment, and mechanical handling facilities, it is essential to carry out a detailed appraisal of financial and other factors before finally choosing equipment.

Upgrading or adaptation of existing buildings

2.7 Although the standards of accommodation set out in this Note are essentially for a new building, they are equally appropriate for the upgrading or re-equipping of existing laundries. However, before deciding to upgrade, consideration should be given to reconciling the long-term strategy for the service, the space required for the new service and the size of the existing building. The siting of the building should be considered in terms of minimising the effect of. discharges from the laundry on adjacent accommodation, and contributing to internal environmental conditions. The adequacy of the necessary support services should be ensured. Upgradings should be functionally sound and appropriate for the projected needs of the laundry service for a number of years to come. A review of physical and other aspects of existing buildings should include:

- availability of space for alterations and additions;
- type of construction;
- physical constraints to adaptations such as load-bearing walls and columns;
- insulation;
- age of the buildings and condition of fabric, for example external and internal walls, floors, doors and windows (which may be determined by a condition survey);
- life expectancy and adequacy of engineering services including steam-raising boiler plant, ease of access and facility for installation of new wiring and pipework;
- changes of floor levels to obviate hazards to disabled people;
- fire precautions (see paragraphs 3.25–3.28);
- access and egress for laundry vehicles.

2.8 When comparing the cost of upgrading or adapting an existing building with that of new building, due allowance must be made not only for the building cost but also for the cost of relocating people, demolition, salvage costs and disruption of services in a phased project. The temporary effects on running costs of any impaired functioning of related areas must also be taken into account.

2.9 The cost of upgrading work should conform to the guidelines indicated in the Department's WKO letter (81)4 'Upgrading and adaptation of existing buildings', revision of DS183/74 24 July 1981, (in Wales AWO(81)8). Those guidelines take into consideration the estimated life of the existing building and the difference in cost between upgrading and new building.

Location

2.10 The laundry will generally be sited within the curtilage of a hospital and should be located as near as possible to the boilerhouse to minimise distribution losses. The economic appraisal of alternative locations and design solutions should include the heat conversion and distribution losses to the point of use. There should be easy access to the principal hospital service roads and to public roads; and sufficient space to ensure that vehicles can manoeuvre, turn round and park easily at reception and dispatch bays. Where the laundry is an offsite facility, it should be sited with convenient access to the principal main and trunk routes which serve those hospitals sending articles to the laundry. The local authorities should be consulted about any proposed schemes which might have some bearing on future transport facilities. The siting of the laundry complex should take into account the extent to which unwanted noise and lint deposits are likely to be transmitted to adjacent areas. The environmental impact, under EC regulations, will also have to be considered.

2.11 In the case of laundries processing 100,000 pieces or more, the availability of staff in the area is a major consideration. The laundry should be sited in an area where there is a reasonable public transport system to enable staff to reach the site.

2.12 There must be a source of water supply sufficient for the needs of the laundry, and the appropriate water authority must be consulted on this matter. The discharge of effluent must also be considered with the appropriate authority, and reduction of effluent charges based on losses from laundry processes should be negotiated. Both these aspects should be dealt with at the earliest planning stage.

2.13 An adequate electric power supply must be available. The level of stand-by power to be provided should be in accordance with Health Technical Memorandum (HTM) 2011 – 'Emergency electrical services'.

2.14 There may be operational advantages in siting a central laundry service near the largest user and any sterilizing and disinfecting unit. Account must, however, be taken of the cost factors associated with the external services and the requirements of paragraph 2.10.

Scale of operation

2.15 In general terms, cost benefits are related to the scale of laundering operations. Maximum efficiency will normally be achieved when machinery and equipment used for processing the bulk of flat-work are operating at their optimum production levels, which are determined by the workload capacity of calendering equipment (flat-work ironing machines) and by the type of linen. The total capacities relate to workloads where calendered articles represent about two-thirds of the total number of articles to be laundered. This consideration has influenced the sizes of laundries and scale of equipment covered by this Note.

2.16 The greatest cost benefits will accrue from laundries which process between 55,000 and 150,000 articles per 39-hour week. At the present state of technology a laundry having a throughput of 200,000 articles represents the largest size which is likely to be economic. Throughput can be increased if the number of working hours is increased in proportion to the extra workload.

2.17 Laundries designed for workloads radically different from the sizes selected for this Note may require the installation of machinery which will not permit the best use of labour, floor space and services generally. A correspondingly higher proportion of revenue costs can therefore be expected. Unless there are special considerations such as excessive transport costs, no new laundry having a throughput of less than 55,000 articles a week should be considered.

Workload

2.18 The weight and type of workload must be taken into account when determining what laundry facilities are needed to process a given number of articles per week. Laundry facilities in this Note are based on an average dry weight of 0.432 kg ± 0.020 kg per article. This average weight will vary between one hospital and another because of the difference in the make-up of the workload of individual hospitals, for instance:

a. the type of linen:

   (i) cotton,

   (ii) poly/cotton,

   (iii) synthetic;

b. the style of bed assembly:

(i) conventional,

(ii) duvet;

c. patient throughput.

Fabrics

2.19 The continued development of articles manufactured from fibres and mixes of fibres other than cotton has led to the development of new equipment and new procedures, and provided the means of energy-saving methods. The increased cost of such articles should not be judged in isolation but assessed against the benefits of longer life and reduced processing costs. Guidance on textile bedding and fire retardance is given in Firecode HTM 87 – 'Textiles and furniture'. This deals with textile bedding items used on hospital wards and other healthcare areas used by patients.

2.20 Polyester cotton in the form of sheets, drawsheets and pillowcases has increased the potential for higher levels of production from existing plants and reduced the energy demand where all the procedural processing systems have been adopted. The same comment applies to nurses' uniforms, white coats and gowns.

2.21 Special fabrics being developed for theatre use, although currently expensive compared with the equivalent cotton article, are proving to have considerable benefits in terms of length of life and laundering costs.

2.22 Articles manufactured from synthetic fabrics have a long life and very low energy demands in processing. However, several factors should be borne in mind when considering the processing of polyester, a major one being static electricity; another is that for those laundries dealing with different fabrics some equipment over-dries synthetics during the time they are in process. Synthetic sheets through a four-roll sheet calender is a typical example.

2.23 Project teams should be aware of the latest technology of fibre and fabric development, and its effects on laundry processing should be taken into account.

Duvets

2.24 Many hospitals are using duvets, particularly for long-stay patients. Purchases are frequently made without prior consultation on the effect they may have on laundry production.

2.25 Covers manufactured with press-studs will not calender without damage to the press-stud and possibly to the ironer. Velcro fastenings will quickly lose their efficiency through the heat and pressure of calendering. These problems can be overcome by constructing the cover in the same manner as a pillowslip, that is with a large interior flap into which the duvet is tucked.

2.26 The duvet itself, if it is to be washed, takes a considerable amount of space in a machine, and also in a tumble-drier. Production capacity is therefore reduced. In the case of tumbling the effect is twofold, first on capacity of the tumbler, and second the greatly extended drying times necessary to ensure that the filling of the duvet is dry. Washing machine production level is also adversely affected by the considerably extended washing times required to ensure thorough thermal disinfection.

2.27 Duvets themselves, to avoid constant washing, require some external membrane-type cover which does not allow penetration of liquids and soil, but does allow sponging clean when necessary. Routine internal sampling will also be required to monitor bacterial ingress.

Quantifying and classifying workload

2.28 A final assessment of the plant and machinery required for a particular laundry can be made only by compiling a list of types and quantities of articles to be laundered weekly. Against each type of article on this list may be entered its weight and the type of finish which is acceptable, for example calendered, tumble-dried, tunnel finished. It is then possible to analyse by weight and number the quantity of work in each of the main finishing classifications. From this analysis the size, type and number of machines needed to handle respective workloads may be determined, and suitable flow-lines planned.

2.29 If information regarding articles per staffed bed is not available, the estimates in Table 1 will serve as a guide. Where known demands are in excess of these quantities, authorities should satisfy themselves that there is no excessive use of clean linen.

Table 1 Estimated weekly laundry per staffed bed

Type of hospital	No of articles	approx. weight per article (kg)
Large district general	59–64	0.480
Acute and mainly acute	43	0.453
Geriatric and long-stay	52	0.449
Mental illness and mental handicap	41	0.375
Maternity	100	0.375

Note: The above figures assume the use of conventional bedding. If a significant number of disposables are used, the number of articles will be less but the average weight per article is likely to increase. The use of duvets will also have a similar effect.

2.30 If in the early stages of project planning, details of the make-up of the total workload are not known, the estimated total quantity using the information in Table 1

may be subdivided by weight into about 50% large flat-work, 15% small flat-work and 22% tumble-dried work. The remainder of the articles will probably represent tunnel finish work. It has been assumed for the purpose of this guidance that infected linen will make up about 5% of the total weight of all work classifications, but there may well be deviations from this percentage. A thorough assessment of actual requirements will be necessary as the project develops.

Complete linen service

2.31 The laundering process is one facet of a complete linen service which requires it to be linked effectively with:

a. correct use of the recommended colour-coded bagging of linen, which will assist in the laundry "flow-line" and avoid double handling;

b. collection of used and infected linen;

c. repair of damaged and worn articles and their condemnation and replacement;

d. measuring, fitting, alteration, marking and repair of uniforms and patients' clothing;

e. assembly, packing and distribution of the finished work to the respective users.

Most of these functions are covered by this Note but, in order to achieve the greatest efficiency for a complete linen service, careful integration and management of all functions is necessary.

2.32 A hospital's operational policies for the use, handling, transportation and processing of linen should therefore aim at effective integration to take account of standardisation of the type of linen, reduction of variety in classifications of linen, common usage and adequate stocks.

2.33 The design of the building and internal layout should permit separation of infected linen and the remaining normally-used linen in accordance with 'Hospital laundry arrangements for used and infected linen' – HC(87)30 (in Wales WHC(88)4). Arrangements should ensure that infected linen is delivered to an area separate from the rest of the used linen storage space.

2.34 Before a decision is made on the space and equipment required for the repair room a careful assessment should be made of actual needs in terms of the most economic and convenient system for dealing with repair of the main categories of linen, that is ward linen, theatre linen, uniforms and protective clothing and patients' clothing. If a proportion of the repair work is carried out in hospital premises other than the laundry the space allocated should be reduced accordingly.

Linen recognition systems

2.35 All items should be prominently marked for visual identification to discourage pilfering. The long-term development of the NHS laundry service will include the use of bar-coding and/or transducers. It is recommended that a single bar-code system be used throughout the laundry industry because of the requirement that the bar-code system has to match the bar-code reader. This will enable the NHS to keep track of how linen moves around from one site to another. It is envisaged that this system will assist in linen control, stock levels, identifying where linen losses are taking place, management systems etc. It will not be cost effective to bar-code all items of linen and a guide will be the cost of the article and loss rate.

Central linen storage

2.36 Nucleus Study Report No 20, DHSS November 1987, provides guidance to determine an operational policy for linen supplies and services within Nucleus hospitals. The findings are applicable to other types of hospital and are based on a linen exchange trolley system.

2.37 Many hospitals maintain their own central linen stores. The introduction of a group laundry, however, may encourage a revision of local policies. It may be decided to provide a central linen store within the laundry and eliminate individual stores within the hospitals served, but a distribution centre will still be needed. With the introduction of competitive tendering arrangements the hiring of linen is an option and the provision of a central linen store within the laundry becomes an essential requirement. In such cases, clean linen can be placed on free-standing, and perhaps mobile, racking direct from the finishing plant, with consequent staff economy in avoiding double handling. Additional floor space in the packing and dispatch section of the laundry will be required for this store.

2.38 At hospitals without a laundry it will be necessary to provide space for:

a. a secure soiled linen holding bay;

b. a secure linen distribution centre.

The Schedules of Accommodation (see Chapter 6) contain suggested areas for this purpose related to hospital "beddage". Suitable facilities will also be required at such hospitals for loading and unloading soiled and clean linen.

Transport

2.39 Clean articles should not be allowed at any time to come into contact with used and infected articles. Clean articles of laundry must not be carried at the same time or

in the same vehicle as used and infected articles, unless separated by a waterproof partition or barrier. All vehicles used for transporting either clean or used articles, or both, must be regularly cleaned and disinfected. Project teams should take local policies into consideration when selecting the types of vehicles to be used and the provision to be made for their accommodation.

Waste disposal

2.40 A collection system for waste from various sections of the laundry, for example polythene bags in the disinfection area, will be required. Provision should be made within the laundry complex for the storage, before disposal, of rubbish in "Palladin bins" located on a hardstanding outside the laundry.

Disposal of condemned linen

2.41 A space may be required, adjacent to the central linen store, for the storage of condemned linen so that sufficient stocks can be built up for disposal/sale of this linen.

Patients' personal clothing (PPC)

2.42 The present policy of providing a fully personalised clothing service to long-stay patients, with garments and articles marked to the individual patient, as well as encouraging patients to provide some of their own clothing, has resulted in hospital laundries handling a range of articles unsuitable for bulk washing in large-capacity washer-extractors. If a PPC laundry is constructed as a separate entity provision should be made to cope with infected articles of clothing.

2.43 Studies indicate that with a full PPC service, the number of articles generated per patient, or occupied bed, ranges between 15 and 50 articles per week, depending on the type of patient and the degree of usage of incontinence aids. The average number of articles per week over the range of specialties is 25, with an average weight of 0.23 kg per article.

2.44 A typical PPC laundry workload is shown in Table 2.

2.45 The trend towards garments manufactured from synthetic fibres demands that washing processes, materials and temperatures must be suited to the needs of the particular fibre, fabric, colour or imparted fire-retardant properties. Washing in bulk quantities will not allow flexibility in the range of processes needed to avoid problems.

2.46 Reduced length of life, fabric distortion, shrinkage, colour loss and destruction of fire-retardant properties have in the past resulted from the use of unsuitable washing machinery and processes.

2.47 Studies indicate that about 60% of the PPC workload will usually consist of underwear and nightwear articles suitable for washing in reasonably sized quantities, and about 40% will comprise daywear and special articles needing specialised washing in small discrete quantities.

2.48 The present policy of transferring long-stay patients to the community, coupled with the provision of long-stay patient facilities at District General Hospitals, has resulted in a reduction in beds at many large long-stay hospitals. As

Table 2 Typical PPC laundry workload

Workload breakdown	Articles per week			
	3000/3500	4500/5000	6000/7000	12000/14000
Maximum number of articles per week	3500	5000	7000	14000
Maximum number of articles per hour	106	151	211	422
Maximum weight per week (kg)	808	1151	1609	3218
Maximum weight per hour (kg)	24	34	48	95
Weight per hour (underwear/night wear) 60% (kg)	15	20	29	57
Weight per hour (specials/colours etc) 40% (kg)	9	14	19	38
Finishing – tumble-dry (fully) kg/hr 60%	15	20	29	57
Tumbler-conditioning for steam/air tunnel kg/hr	9	14	19	38
Steam/air tunnel/press/articles/hour 55% of volume	57	81	113	227

Notes:

1. Working week assessed at 39 hours at 85% plant utilisation – 33.15-hour effective working weeks.
2. Average weight taken at 0.23 kg per article.

a result many of these will no longer be of sufficient size to justify a purpose-built PPC laundry.

2.49 Generally the most economic solution may be to add a specialised PPC laundry section to a hospital laundry which processes ward and bed linen, thereby utilising the base services already available. Care must be taken to ensure acceptable turn-round times for the sending hospital.

Dry cleaning

2.50 With the increasing use of washable clothing manufactured from synthetic fibres, the volume of articles that require dry cleaning has reduced to a level that for many hospitals makes dry cleaning in-house an uneconomic practice compared with the cost of contracting out dry cleaning. With the advent of income generation the spare capacity could be used by selling this service to hospital staff and patients.

2.51 Dry cleaning should be undertaken only if it is certain that there will be sufficient work (usually not less than 670 kg per week) to keep dry-cleaning equipment fully employed through the week. The capacity of dry-cleaning units is measured in dry weight per week. Reliable statistical information on workload generated by different types of hospital is not available, and an estimate of requirements will need to be made for each project. Hospitals with a majority of medium- to long-stay ambulant patients who will use their own outer clothing are likely to generate a greater need for dry-cleaning facilities than other types of hospital.

2.52 It is essential that all current legislation on the use and storage of dry-cleaning solvents be strictly observed, with particular regard for security and unauthorised access. The UK is party to the Montreal Protocol* which controls the production and supply of substances that deplete the ozone layer. The protocol requires the phase-out of chlorofluorocarbons (CFCs), halons, carbon tetrachloride and 1, 1, 1 trichloroethane.

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* Advice on the Protocol requirements and timescale is available from:
Department of the Environment
Global Atmosphere Division
Room B257
Romney House
43 Marsham Street
London SW1P 3PY.

3.0 General functional and design requirements

Design and construction

3.1 The laundry will only function effectively if the building is planned in strict accordance with the production sequence (see Figures 1 and 2). A building at one level is generally the most convenient for plant layout, services arrangement and management. However, a mezzanine floor to accommodate storage and sorting of used linen above the wash area can assist in the top-loading of washing machines and will reduce the area of site occupied by the building. Further savings might be achieved by siting the staff room and staff changing facilities on the mezzanine floor.

3.2 The main part of the building will be a production area with administrative and other supporting accommodation. An industrial-type building of lightweight construction is suitable for the main working area. The floor should be clear and sufficiently free of structural support to avoid restriction of the layout of plant and obstruction of workflow.

Environment

3.3 The plan of the building and its cross-sectional profile should permit the introduction of clean air via low-level openable windows, preferably from both sides of the main heat-emitting area. Ventilation induced by wind pressure can promote high air change rates through a building if air is able to move freely within the space from the windward to the leeward side of the building. Internal partitions, fire compartment walls and closed doorways can, however, often impede the flow path and when this happens the process will be more dependent on single-sided ventilation. The aim of the ventilation system is to have air flow from the finishing area to the dirty sort area, to assist in prevention of bacterial cross-contamination.

3.4 A minimum height of 6.5 m to eaves, of that part of the building which accommodates tumble-driers, calenders and garment finishing equipment, is considered necessary to achieve a satisfactory operator environment. Experience has shown that a roof-pitch of a minimum of 10° is the optimum necessary to avoid the formation of stagnant pockets of hot air without incurring weathering and maintenance problems with the extract fans.

3.5 Hot air should be extracted via fans mounted on the roof above the heat-emitting area. Access should be provided for maintenance of these fans without interfering with smoke detection systems. Space heating is necessary in cold weather for parts of the laundry where there is no processing plant radiating heat. The main requirement is the provision of cool, comfortable working conditions. Either adjustable louvres or openable windows will also be required at high level in order that the pattern of air movement may be modified to suit the varying climatic conditions. The use of flexible flap doors will reduce cold draughts and door damage where trolleys are used.

Lighting

3.6 The production area should be provided with good natural lighting, though solar glare must be avoided.

Unloading and loading bays

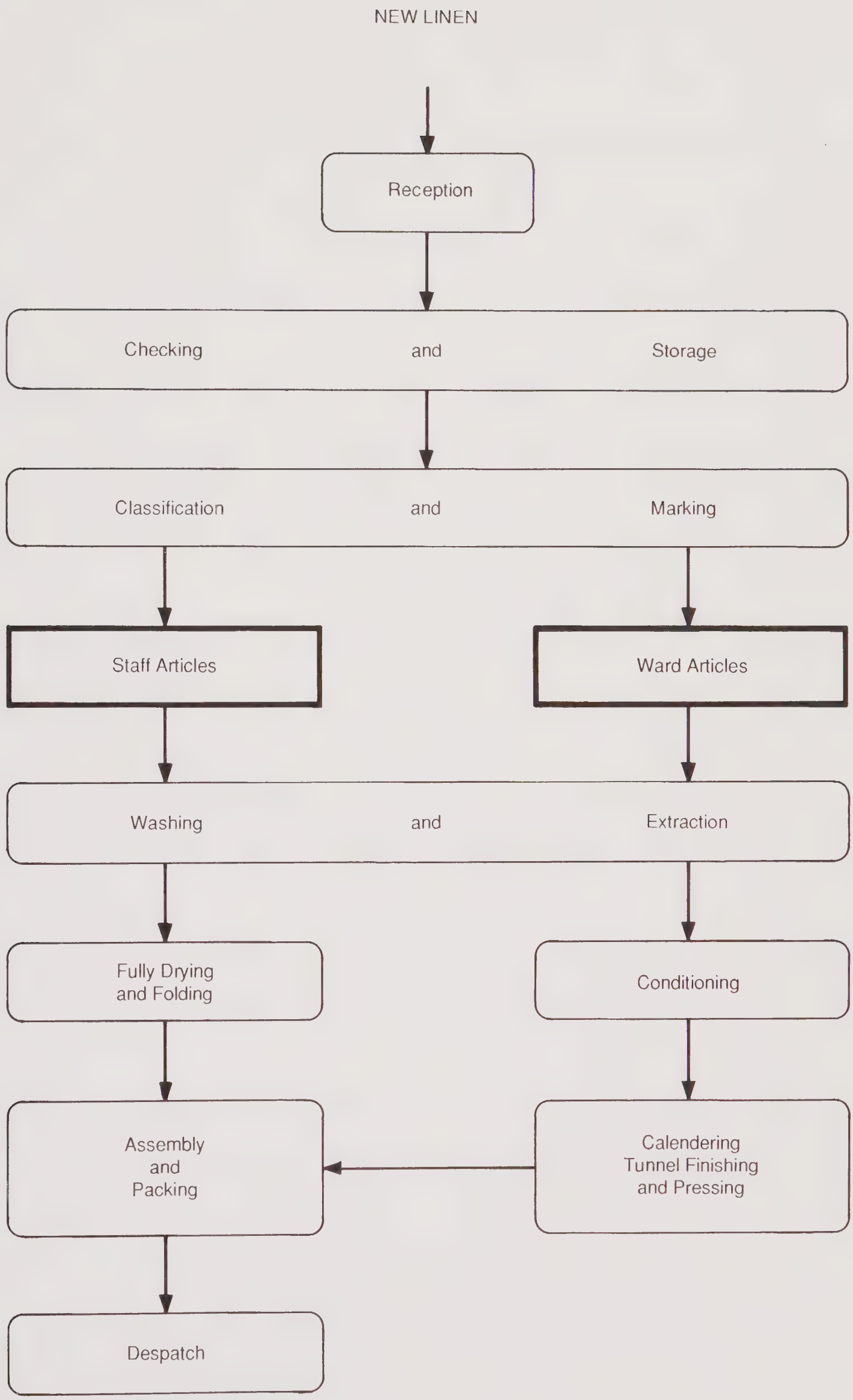
3.7 Unload and loading of vehicles at the reception and dispatch bays respectively will be assisted by arranging the common floor level at those points to be at tailboard height unless the use of a vehicle with a tailgate lift is envisaged. General site levels will determine how, if at all possible, this may be done. If a change in level is possible at one end of the building only, preference should be given to the dispatch bay. Clean linen will often be dispatched on trolleys which are returned to the same bay when empty. If soiled linen is returned on the clean linen trolleys it is essential that they are disinfected before re-use for the returned clean linen.

3.8 Although barrier facilities for infected linen are not required, it is essential for a section of the reception area to be set aside for the temporary storage of infected linen prior to being loaded into dedicated washer-extractor machines.

Foundations

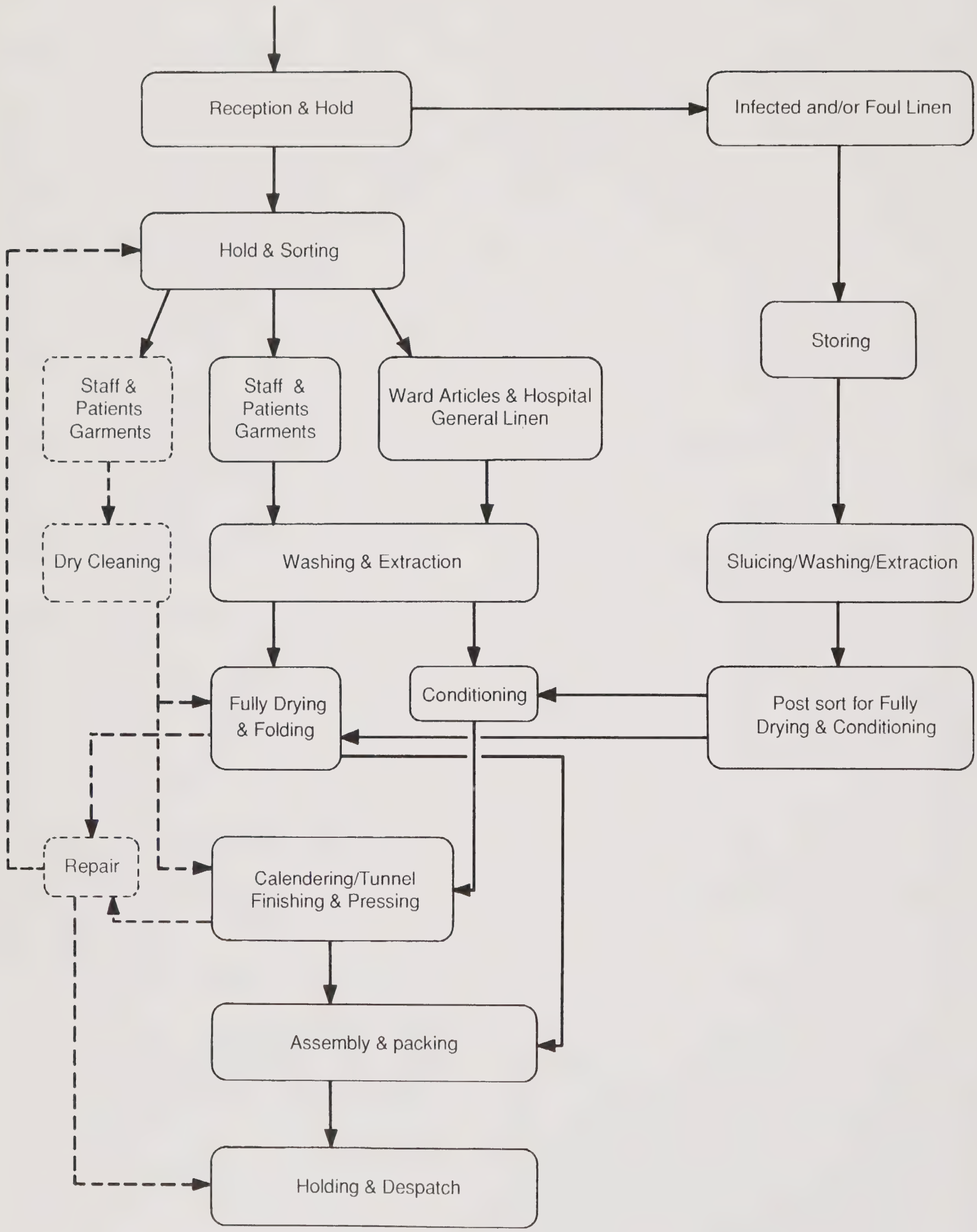
3.9 Foundations for the various machines should be provided in accordance with the maker's requirements. Account should be taken of the type of machine and the load-bearing capacity of the soil. It is seldom economic to provide a completely strengthened floor in the machinery areas. It will usually be more convenient to provide at the outset of a new development the foundations for additional machinery which is to be installed at a later stage. Particular care must be exercised in relation to the vibration caused by machines such as washer-extractors and large-capacity tumble-driers.

Figure 1 Activity Flow Diagram



Note: For definitions of soiled and fouled linen, see 'Hospital laundry arrangements for used and infected linen' – HC(87)30 (in Wales, WHC(88)4).

Figure 2 Activity flow diagram – used and infected linen



Note: For definitions of soiled, Fouled and infected linen, see 'Hospital laundry arrangements for used and infected linen' – HC(87)30 (in Wales WHC(88)4).

Floor finishes

3.10 Floor finishes will vary and should be carefully selected to satisfy the requirements of each area. All floors should be non-slip and easily cleaned. Finishes in the production area should be robust enough to allow the machinery to be moved over them without lifting or cracking. In the wash area it is important that it should be non-slip when wet, and adequately drained. In the wet sections of production areas and in those areas where release of water may be occasionally unavoidable, for example, calorifier, water-softening and tank rooms, floors should be laid with a fall to drain. Steam, condensate and hot water should not normally be carried in ducts in the floor; distribution from high level is preferred.

Wall finishes

3.11 Wall surfaces should be easy to clean and some protection at low level may be needed to prevent trolley damage. The structural members should be selected to minimise the lodgement of lint, which is prevalent in laundries.

Roofs

3.12 The roof structure should be designed to provide safe access to roof extract units.

Washing and packing processes

3.13 On reception at the laundry, used articles are initially held, then sorted and classified into loads according to the washing, re-assembling and other processes employed, and any temporary marking required is done in this area. There are usually two main flow-lines – one for ward and other articles and one for staff and patients' personal articles excluding those which will need to be dry cleaned.

3.14 After washing, ward articles are dealt with mainly by calendering (for sheets and other flat-work) or tumble-drying (for bath towels, cotton blankets etc). They are then re-assembled according to type, or in some cases destination, before being packed for dispatch. If a central linen store is provided within or adjoining the laundry a proportion of the ward articles may be transferred to the linen store racks immediately after being calendered or dried. Otherwise, the re-assembling and packing of the clean articles may be undertaken in the packing department. An alternative to the latter arrangements, sometimes used in smaller laundry units, is to pack bed linen on the delivery side of the flat-work ironing machine. After washing, staff articles are finished mainly by pressing or by steam/air finishing units, or returned on hangers.

3.15 The Guide to Good Manufacturing Practices for National Health Service Sterile Service Departments, 1989 (GGMP) requires that theatre linen should be protected from particulate contamination by a protective wrapping – a suitable process being shrink-wrap polythene before dispatch to the sterilizing and disinfecting unit.

Line repairs and marking

3.16 Articles referred for examination and repair from the processing areas will be passed to the linen repair room. It is preferable for final examination of theatre linen for tears and stains to be carried out in the laundry by suitably trained staff.

3.17 Before a decision is made on the space and equipment required for the repair room, a careful assessment should be made of actual needs in terms of the most economic and convenient system for dealing with repair of the main categories of linen, that is, ward linen, theatre linen, uniforms and protective clothing, and patients' clothing.

3.18 If a proportion of the repair work is carried out in hospital premises other than the laundry, a correspondingly smaller space will be required in the laundry.

Patients' personal clothing – washing, drying and finishing

3.19 Project teams should examine carefully the range of patients' personal clothing (PPC) articles and install a mix of appropriately sized washing machines to suit the workload. Guidance on a range of suitable-capacity washing machines for various workload volumes is given in Appendix 4, but the balance of machines to suit a particular requirement may need to be modified.

3.20 There are various methods of finishing PPC articles which give different end results and it is for the users to agree acceptable standards and methods of finishing. Studies made at those health authorities where attention has been paid to upgrading the PPC service indicate that the finishing methods set out in Table 3 provide acceptable standards of finish at economic cost levels.

Table 3 Finishing methods for PPC laundry

Article	Finishing method (depends on fabric)
Women's nightwear (night dresses)	Tumble-dry/fold, steam/air tunnel, press
Women's underwear (slips, vests, pants, bras etc)	Tumble-dry/fold, steam/air tunnel
Women's day and outer wear (dresses, blouses, skirts, slacks)	Steam/air tunnel, press
Women's stockings and tights	Tumble-dry – in nets
Men's nightwear (night-shirts, pyjamas)	Tumble-dry/fold, steam/air tunnel, press
Men's underwear (vests, pants)	Tumble dry/fold
Men's day and outer wear (jackets, trouser, suits, cardigans)	Steam/air tunnel, press
Men's socks	Tumble-dry (fold in pairs)
General apparel (bed jackets, dressing gowns etc)	Tumble-dry/fold

Note: Tumble-dry finishing method presumes tumble-dry with cooling down and folding immediately to avoid creasing.

3.21 Studies undertaken at laundries where users have carefully chosen a range of PPC articles with suitable fibre/fabric construction, indicate that about 55% of the articles may be finished to an acceptable standard by steam/air tunnel finishing, or press finishing, and about 45% by fully drying and folding.

3.22 It may be possible in some cases to utilise spare capacity available on the steam/air tunnel finishing equipment in the main laundry for finishing PPC articles.

Statutory and other requirements

3.23 The guidance takes account, as far as possible, of all statutory and other requirements in force at the time of publication, but health authorities and trusts are reminded of their responsibility for ensuring compliance with all relevant statutes, regulations, codes and standards. Advice on this is given in HC(88)60/HC(FP)(88)29 (in Wales, WHC(89)20). With the general removal of Crown immunity. building and planning laws are legally enforceable upon the NHS. Guidance on the removal of Crown immunity is given in HN(90)27/LASSL(90)15 (in Wales, WHC(91)4) in respect of a wide range of legislation.

3.24 If any major accidental spillage of laundry wash products occurs and goes down the drain, the water effluent treatment company should be informed immediately of the event so that appropriate action can be taken.

Fire precautions

3.25 It is essential that project teams familiarise themselves with the guidance contained in the 'Firecode' series of documents, which together contain the Department's policy and technical guidance on fire precautions in NHS premises. In particular, the need for structural fire precautions and means of escape from the whole accommodation must be taken into account at the earliest possible planning stage.

3.26 The key document for these aspects in hospitals is 'Firecode: Fire precautions in new hospitals – Health Technical Memorandum (HTM)81 and its supplement. In addition, the documents include the HTM '80' series, which gives technical guidance on various building, engineering and equipment issues; and the Fire Practice Notes (FPN), especially FPN 1 – 'Laundries'. Existing HTMs will, in due course, be re-issued in Firecode format. 'Firecode: Directory of Fire Documents', which lists references to relevant legislation and fire precautions guidance issues by DH and other sources, for example the Home Office, will be updated to the latest standard version.

3.27 The principles of fire safety apply equally to new projects and to alterations and upgrading of existing buildings. At appropriate stages of the design process, the architect and engineer should discuss and verify their proposals with the local fire authority and ensure that the project team and all other planning staff are fully acquainted with the fire safety strategy for the design in

terms of operation and staff responsibilities etc. HTMs 56, 57, 58, 59, 60 and 65 give detailed information on the selection of fire-resisting components and fire signs.

3.28 Tumble-driers and tumble-dried loads present a potential fire risk. Instructions to employees as to the safe operation of tumble-driers and the handling of dried loads should be displayed in prominent positions.

Security

3.29 Assaults on hospital staff and theft of NHS property are recognised problems. The project team should discuss security with the officer in charge of the local police crime prevention department and the hospital or district security officer or adviser at an early stage in the design of the building. Fire and security officers should be consulted concurrently, because the demands of security and fire safety may sometimes conflict. The attention of planners is drawn to NHSME Circular HSG(92)22 (in Wales, WHC(92)86) about Security, and the revised NHS Security Manual to which it refers.

Smoking

3.30 Health Circular HC(85)22 (in Wales, WHC(85)31) dated May 1985 provides guidance about smoking in health buildings. While recognising that the responsibility for determining local policies rests with the health authority, the circular recommends that smoking should be restricted to specially designated areas which are clearly signposted. In the case of laundries this should be limited to offices and the staff rest room. In such areas ventilation should be sufficient to prevent discomfort to non-smokers and the spread of odours to other areas of the premises. Smoking is not allowed within the production area.

Maintenance and cleaning

3.31 Materials and finishes should be selected to minimise maintenance and be compatible with their intended function. Building elements that require frequent redecoration or are difficult to service or clean should be avoided. Special design consideration should be given to elements such as entrances, corners, partitions, work benches and any others which may be subjected to heavy use. HTMs 56, 58 and 61 give guidance on these aspects for partitions, internal doorsets and flooring.

Internal spaces

3.32 Internal rooms may contribute to economy in planning, but because they require artificial lighting and mechanical ventilation, capital and running costs are increased. Such rooms do not provide good working conditions. Internal spaces should be used only as supporting service rooms, or for activities of infrequent or intermittent occurrence, or which demand a controlled environment.

Disabled people

3.33 It is essential that suitable access and facilities are provided for disabled people who have problems of mobility or orientation. This includes, besides the wheelchair-bound, those who for any reason have difficulty in walking and those with a sensory handicap such as a visual or hearing impairment. Authorities are reminded of the need to comply with the provisions of:

a. the Chronically Sick and Disabled Persons Act 1970;

b. the Chronically Sick and Disabled Persons (Amendment) Act 1976;

c. the Disabled Persons Act 1981;

d. the Disabled Persons (Services, Consultation and Representation) Act 1986;

e. the Building (Disabled People) Regulations 1987.

Attention is also drawn to BS5810 – 'Access for the Disabled to Buildings'. One of the effects of the 1981 Act is to apply this British Standard to premises covered by the 1970 Act, which includes those open to the public. Practical guidance for complying with the Building (Disabled People) Regulations is issued by the Department of the Environment under Approved Document M – 'Access for the Disabled ' Project teams should refer to HBN 40 Volume 4 – Common activity spaces – designing for disabled people. This gives guidance and a set of ergonomic data sheets on access, space and equipment relating to disabled people in health buildings. Project teams may wish to consult local representatives of disabled people about the planning of this department.

4.0 Specific functional and design requirements

Introduction

4.1 This Chapter provides guidance on the functional requirements and design implications for the activity spaces within the four sizes of laundries covered by this Note. Figures 3 and 4 illustrate two alternatives on layout of machinery and the interrelationship of activity spaces. The linear machinery layout (Figure 3) will normally be used for upgrading existing laundries. Where practicable and for new laundries the U–form machinery layout (Figure 4) is recommended. This form has advantages over the linear layout for ease of trolley movement from dirty to clean side of the laundry and the on-costs will be reduced by having a common vehicular access and unloading/loading facilities.

4.2 The following activities will need to be accommodated within a laundry:

a. reception;

b. sorting, classification, marking and storage;

c. washing, drying, conditioning, calendering and pressing;

d. repair – where necessary;

e. assembling and packing;

f. dispatch.

4.3 All the above elements should be considered at the same time to ensure that the design facilitates an easy flow of articles along the production line from reception to dispatch.

Unloading reception bay

4.4 An unloading dock should be provided at a level suitable for offloading used and infected linen from vehicles at the reception bay. To minimise draughts and provide adequate security, a covered area with lockable shutters is recommended with an external canopy. The canopy should protrude about 1.2 m and project teams are advised to take into consideration the maximum height of any delivery vehicles.

Linen handling system

4.5 A monorail system for conveying soiled linen in bags has many avantages. It keeps work off the floor, reduces manual handling, and can be used for the temporary storage of soiled linen. For a laundry capacity of 55,000 articles it may be considered adequate to hold the incoming work in the mobile containers, within the reception area, and omit the monorail system.

4.6 The system should be designed so that as bags of soiled linen are unloaded from a vehicle they may be transferred directly and conveniently to the monorail. The storage conveyor rails should terminate at one or more stations where the contents of the bags may be discharged ready for classification. Where site area is limited, consideration may be given to arranging storage conveyors in banks one above the other; this will usually require a local increase of ceiling height. It is desirable to keep the floor completely clear of the conveyor structure in the actual working areas but this is not essential in an area used solely for storage. There are various designs of conveyor systems for the storage and transit of classified soiled linen. Some are suitable for suspension from the roof; some are supported from independent columns; others combine both methods. Roof suspension of the conveyor may require local strengthening of the structure. The operating requirements and the construction costs must be integrated to obtain the lowest total cost solution.

4.7 The capacity of the system should be sufficient to cope with the peak intake of soiled linen accumulated over the weekend and to provide the reserve necessary to keep the plant fully employed. A total storage capacity of up to eight hours unclassified and two hours classified soiled work should be sufficient to meet this requirement and to maintain normal production of the laundry. The project team should consider the requirements for this storage space to maximise the capacity required. Additional soiled linen which accumulates during holiday weekends may be accommodated on the floor of the storage area.

Infected linen

4.8 Infected linen, including that made from heat-labile fabrics, should be received from the sending hospitals in water-soluble membrane/water-soluble bags, enclosed in an outer nylon, synthetic or equivalent bag. This enables the contents of outer bags to be tipped, untouched by operators, into the washing equipment. Normal linen classification (see paragraphs 4.11 to 4.17) will not therefore apply to infected linen. There should be a separate mechanical handling system for infected linen, which may be used for temporary holding.

Figure 3 Diagrammatic linear workflow layout

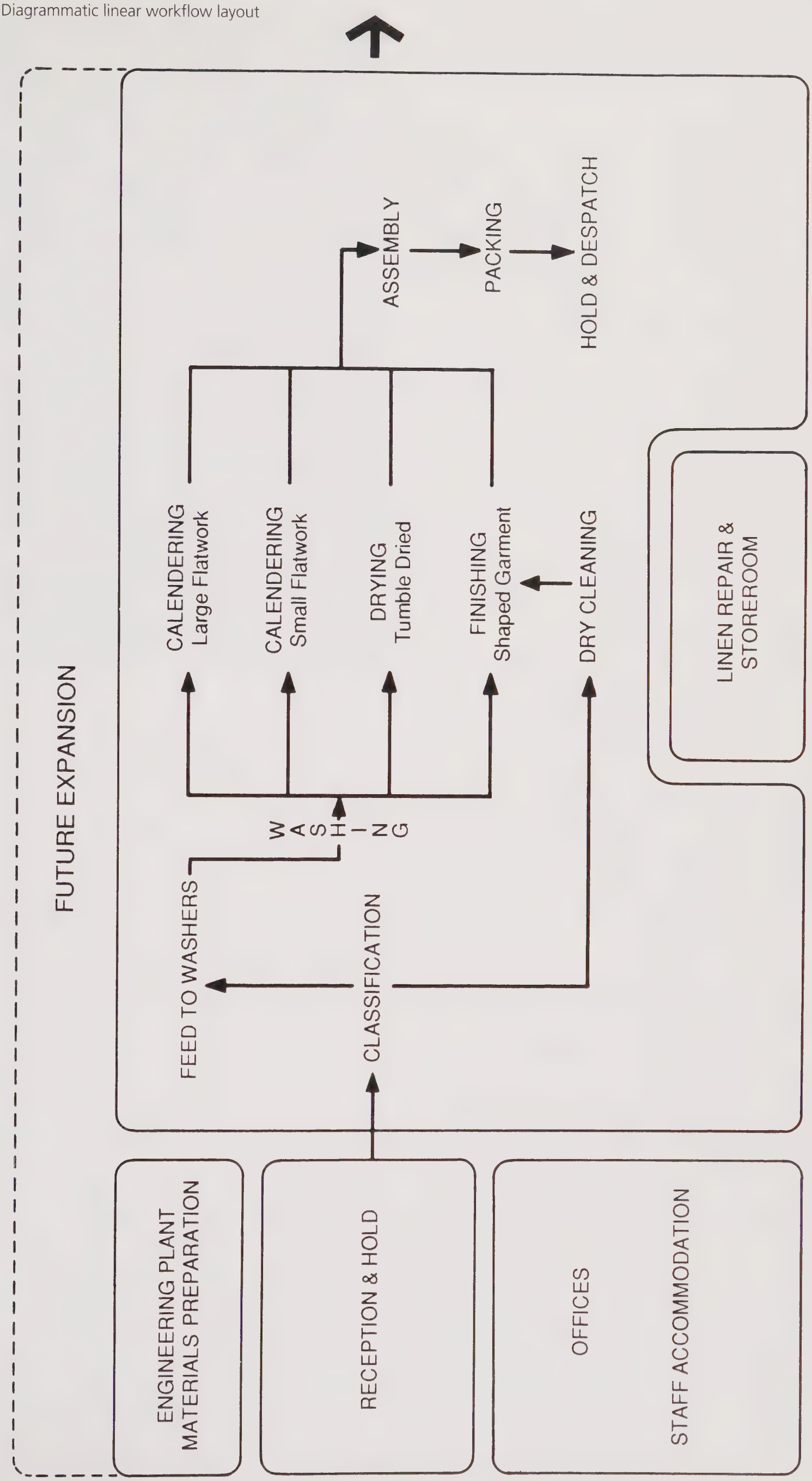
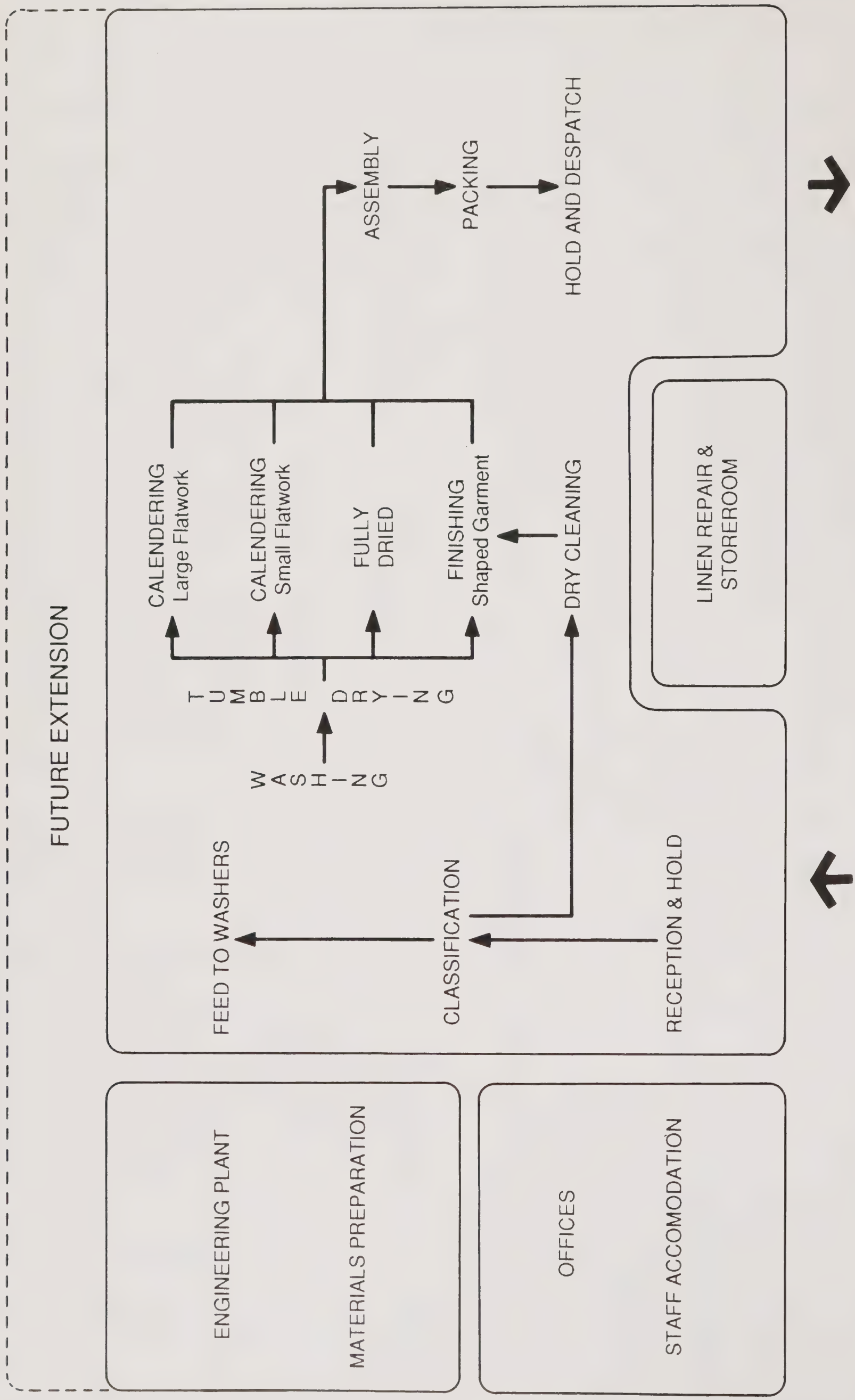


Figure 4 Diagrammatic U-form workflow layout



Fouled linen

4.9 Fouled linen may be treated similarly to infected linen, depending on the advice given by the local Control of Infection Committee. It is recommended that fouled linen should be put into an inner lined bag to prevent seepage and contamination of normally soiled linen.

Non-infected linen

4.10 Soiled linen, which is neither infected nor fouled, will need to be separated into ward articles and staff and patients' garments. This should be done at reception where personal work can be stored separately for subsequent transit to the checking and sorting stations.

Classification of linen

4.11 Efficient utilisation of equipment depends upon a continuous supply of correctly weighed and suitably classified soiled linen to ensure an uninterrupted flow of work through each production line. Where continuous washing plant is employed a degree of "in process" sorting may be justified.

4.12 This Note provides for the classification and storage of batch processing loads in weighed bags or conveyors for laundries dealing with 55,000 articles per week, and weighing stations for other laundry sizes. Alternative systems which may be better suited or essential for specific washing systems can be used.

4.13 The classification system will depend to an extent on the type of washing plant to be served and whether the sorting area is on the same floor level as the washing equipment or above it. Whichever system is chosen, staff in the washing area need to be able to identify the various categories of classified work available for washing. They also need to know the weight of each batch.

4.14 In a laundry dealing with 55,000 articles, soiled ward articles may be classified and weighed directly into loads for the washing equipment. In larger laundries it may be preferable to classify generally by type (large flat-work, small flat-work, tumble-dry etc) and then sub-classify into weighed or measured loads.

4.15 In the section allocated to staff and patients' garments, suitable marking equipment or marking machines will be necessary. The degree of mechanical handling of marked and checked articles to their respective classification containers will depend on the quantity of work handled.

4.16 Transit of soiled articles from the soiled storage area to the sorters should be by mechanical means. The method of transit of soiled articles to their respective classification containers will depend on the type of washing equipment employed.

4.17 A procedure should be established and facilities provided for dealing with water-soluble bags of infected linen which have been misdirected to the soiled linen storage area because they were bagged at source in the wrong colour-coded bags. Such bags should be immediately transferred to the disinfection area.

Main production area

Access for plant

4.18 Suitable external doors or removable panels (3 m wide x 3 m high) leading into the production area should be provided for easy entry or removal of plant and machinery. All floor areas between points of access and machinery foundations should be of adequate strength or capable of being temporarily strengthened or bridged.

Infected linen area

4.19 Dedicated washing plant of an appropriate type as described in Appendix 2 should be provided in the disinfection area. If the number of soiled infants' nappies

dealt with is more than about 10,000 weekly, one washer-extractor should be devoted exclusively to this work.

4.20 Washer-extractors used in this area should not be unduly sensitive to load balancing because of the impossibility of accurate sorting and weighing of fouled/infected work which is contained within soluble membrane or soluble bags. The washing machine and the storage systems are interrelated, for example:

a. a monorail storage system will normally call for a "top-side-loading" door machine, whereas,

b. a low-level storage system will require a "side-loading" or "end-loading" door machine.

The inclusion of these types of machine in this Note does not imply that other washing systems should not be evaluated and considered for use. An alternative system should be selected if it:

c. provides a more economic solution based on the concept of total life costing;

d. contributes towards meeting local labour difficulties;

e. complies with the requirements of Appendix 1, paragraph 3.

4.21 A wash-hand basin should be provided in this area.

4.22 Before it is decided to use chutes or step conveyors to aid the loading of washing machines, the problem of disinfecting them should be considered.

4.23 Clean, disinfected work from washing machines in this area should be unloaded, classified, tumble-dried/conditioned and then routed to the appropriate flow-lines in the finishing departments. Where the quantity of infected work exceeds a flow-rate of 100 kg per hour, particular care should be taken in planning this routing in order to ensure that the flow of work is not unduly interrupted.

4.24 The used soluble membrane bags should be collected together in the dedicated work area by an appropriate method and disposed of in accordance with local waste disposal policies.

Staff and ward linen area

4.25 After washing, staff articles are finished mainly by pressing or by steam/air finishing units; they are then stored and prepared for return to hospitals. Ward articles etc are dealt with mainly by calendering (for sheets and other flat-work) or tumble-drying (for bath towels, fire-resistant blankets etc). They are then re-assembled according to type, or in some cases destination, prior to being packed for dispatch. If a central linen store is provided within or adjoining the laundry, a proportion of the ward articles may be transferred to the linen store racks immediately after being calendered or dried. Otherwise, the re-assembling and packing of the clean articles may be undertaken in the packing department. An alternative to the latter arrangements, sometimes used in smaller laundry units, is to pack bed linen on the delivery side of the flat-work ironing machine.

Patients' personal clothing area

4.26 The majority of patients' personal clothing (PPC) can be processed satisfactorily in the main washing, drying and finishing units.

4.27 Where the laundry is required to process work from a large number of long-stay patients, a proportion of garments may not be suited to bulk or semi-bulk processing and small-capacity washing, drying and finishing units should be provided for this purpose (see paragraphs 2.42 to 2.49).

4.28 These small units should be installed in the main laundry in such a way that the workflow can be partially integrated with the main garment processing sections of the laundry and thus provide flexibility in the use of machines and employment of staff.

4.29 Machinery selected should be suitable for the workload and should include a soiled work classifier; hand-washing sink with draining board; spin-drier; washing machine(s) of about 6 kg to 30 kg capacity with spin-drying incorporated; tumble-drier(s) of 14 to 25 kg capacity; drying cabinet for drip-dry garments with hanging rails and racks; steam/air finisher and provision for racking finished work.

4.30 Where PPC is dealt with in a purpose-built PPC laundry, the provision of a reception and dispatch area will be required.

Dry-cleaning section

4.31 A good standard of low- and high-level ventilation and natural lighting is essential in this section. The dry-cleaning plant should be of the automatic (non-flammable) enclosed type. The production area must be designed to ensure an easy flow of articles from reception to dispatch and the plant recommend in Appendix 3 laid out accordingly. See Chapter 5 for ventilation requirements.

Dry-cleaning equipment

4.32 Simple spotting table(s) and spotting equipment for the removal of resistant stains also provide a convenient garment inspection point.

Finishing

4.33 The needs in the finishing department can be met by general garment presses with free steam facilities and steam/air form finishers. Specialised finishing equipment for a particular type of article should not be installed unless its provision can be justified on economic grounds by virtue of the quantity of work involved. In larger dry-cleaning units the use of steam/air finishing units may be justified particularly if they can also be used for wet-cleaned articles.

4.34 In most dry-cleaning units there is no need for complete garment conveyor systems but well designed slip-rails can be used with advantage.

Linen repair and marking room

4.35 Linen referred for examination, repair and marking will be dealt with in this area. Before a decision is made on the space and equipment required for the repair and marking room a careful assessment should be made of actual needs in terms of the most economic and convenient system for dealing with repair of the main categories of linen, that is ward linen, theatre linen, uniforms, protective clothing, curtains and patients' clothing. Accommodation is assessed on the basis of one seamstress for every 15,000 articles laundered per week and an area of 8 m^2 per sewing machine; the marking is based on a given number of positions. Allowance has been made for three seamstresses. Any reduction in these requirements should be reflected in a decrease in the Department Care Allowances.

Theatre linen preparation space

4.36 If the service of theatre linen preparation is to be carried out within the laundry, a separate space for entrance/exit, gowning, clean room, and dedicated cleaners' room, is required.

4.37 The entrance/exit should incorporate a simple non-ventilated air lock, with the doors to this area interlinked so that only one door opens at a time. The gowning and clean room, to be in accordance with the Guide to Good Manufacturing Practice principle and the environmental standards should be to BS5295: 1989 – Part 1 'Environmental cleanliness in Enclosed Spaces: Specification for Clean Rooms and Clean Air Devices ...' in the "unmanned condition".

4.38 The theatre linen preparation area should accommodate two light tables, one for the inspection of large theatre drapes and one for smaller theatre greens; a work table with storage under a desk; racking for storage, and sufficient storage space for incoming and outgoing linen trolleys.

4.39 The dedicated cleaners' room should have immediate access to the gowning and clean room areas. The room should provide easy access for cleaning equipment, manoeuvrability and storage facilities. The environmental conditions must not breach the BS5295: 1989 – 'Environmental Cleanliness in Enclosed Spaces' conditions.

4.40 All staff and visitors must conform to the changing procedures defined for good manufacturing practice before entering the theatre linen inspection and folding area – 'Guide to Good Manufacturing Practice for National Health Service Sterile Service Departments', ISSM, 1989.

Assembly and packing area

4.41 Racking and packing is closely associated with storage and distribution and these aspects should be studied together in planning the laundry. The Nucleus Study Report 20 – 'Whole hospital policies: support services: linen' which provides guidance to determine an operational policy for linen supplies and services within a Nucleus hospital, should be consulted when designing this section of the laundry.

4.42 The organisation of laundered ward linen supplies will depend on whether a hospital has its own linen supply or whether a pooled linen service is in operation. The former requires more complex racking, packing and distribution arrangements at the laundry and should be avoided if possible. Where practicable a pooled linen service, which greatly simplifies the handling of linen stocks, should be adopted.

4.43 A pooled linen service allows improved methods of packing ward linen direct from the laundry production lines into mobile units which can be easily loaded into transport vehicles. These mobile units can be in the form of containers designed to carry specific quantities of articles such as sheets and towels and to be stacked on a

pallet or trolley. There may also be mobile racks designed to hold specific packs or articles, for example staff uniforms, or made up to suit ward unit requirements. Transport vehicles designed for convenient and economic stowage of such mobile units are recommended.

4.44 The practice of wrapping and bagging personal laundry and packages of laundered linen in polythene film is increasing. The justification of the capital needed for machines and equipment for this purpose should not be based solely on hygienic and aesthetic considerations. The total cost, which should include all capital charges, labour, running costs, maintenance and consumption of polythene film, will need to be set against possible savings on handling, storage and distribution and against the elimination of other forms of packaging, such as boxes. A reduction in the loss risk by sealed packaging should also be taken into account.

4.45 A well-arranged flat-belt or gravity-roller conveyor system can usually be used with advantage in the packing department for conveying packed clean linen containers to the dispatch section, or to the vans.

Central linen store

4.46 Clean linen can be placed on free-standing and perhaps mobile, racking direct from the finishing plant with consequent staff economy in avoiding double handling. A buffer stock and new linen supplies should be held in this area for replacement of condemned linen and for emergencies. This stock will require additional floor space in the packing and dispatch section of the laundry.

Condemned linen store

4.47 A secure space within the central linen store is required to hold the condemned linen until sufficient stock has accumulated to ensure satisfactory disposal.

Trolley store and dispatch

4.48 A loading dock is advantageous for dispatch of clean linen. The loading area should be designed to minimise draughts and provide adequate security. A covered area with lockable shutters is recommended. An external canopy should be provided projecting about 1.2 m from the building. There should be adequate space adjacent to the loading bay to enable vehicles to manoeuvre easily and safely. (See paragraphs 3.7 and 3.8.)

Offices and staff accommodation

Main entrance and lobby

4.49 All staff and visitors must enter the laundry through the main entrance. It should give easy access to all areas and should contain clocking-in equipment and a notice board. The entrance lobby should be provided with a waiting area with seating for visitors. A public telephone may be sited in this area for use by staff and visitors. A hatch and window connecting to the general office should be provided so that visitors may contact the clerical staff.

Offices

4.50 There should be separate offices for the laundry manager and two assistant laundry managers (one in the case of the smallest size unit), and a general office for clerical staff. It is desirable that the offices of the assistant manager(s) should be planned to give easy access to and be in sight of the areas controlled by them. The manager's office and the general office should be adjacent to each other. Adequate facilities should be provided for the use of computers.

Staff changing room

4.51 Separate staff changing rooms and sanitary facilities will be needed for male and female staff with sufficient space to accommodate a locker for each whole or part-time member of staff. Each changing room should have an entrance lobby leading to an area with secure hanging rails for outdoor clothing. Wash-hand basins, bench seating and a mirror should be provided and there should be facilities for staff to shower. WC cubicles, each provided with a hand-rinse basin, should be located near the changing room, but must not be within it. The

provision of a WC and hand-rinse basin in the disinfecting area is additional to these requirements.

4.52 The environmental requirements of the Offices, Shops and Railway Premises Act 1963 will apply and reference should be made also to HBN 41 – 'Accommodation for staff changing and storage of uniforms'.

Space for staff uniform fitting

4.53 If adjustment and fitting of staff uniforms is to be undertaken at the laundry, an additional partitioned fitting area and space for hanging rails for garments awaiting alteration or dispatch should be provided within the linen repair room. There must be no duplication with any similar facilities which might be provided in the staff changing area.

Staff room and kitchen

4.54 The staff room should have openable windows with a pleasant outlook and the furnishings and decor should provide a relaxing environment. The staff room and kitchen should cater for those staff who wish to prepare their own meals and beverages. It should be designed to accommodate at least half the total whole-time equivalent staff at one sitting and should be equipped with facilities for heating food, making hot drinks, washing up and storing crockery etc. A drinking-water supply will be needed and a refrigerator should be provided. The introduction of vending machines for either food or beverages within this area may also be considered.

First aid room

4.55 A room should be provided with a wash-hand basin and easy access to WC facilities. It should be furnished with a single bed or couch, two singles for the larger-size laundries, a chair, and a cupboard for secure storage of first aid requisites.

Cleaners' room

4.56 Easy access should be provided to cleaning equipment and materials, and adequate space for manoeuvring machines, emptying and filling of buckets and the routine servicing and cleaning of equipment. There should be unrestricted access to the sink – which should have hot and cold water – and wash-hand basin. The room should be well lit and ventilated so that equipment can dry quickly.

Stores and supplies

4.57 The storage, preparation and use of materials should take full account of the requirements of the Control of Substances Hazardous to Health (COSHH) Regulations 1988.

Solution preparation and storage area

4.58 An area will be needed for the preparation and storage of washing material solutions. The storage of these solutions will be in tanks in bunded walls from which they are pumped to the washing machines. This area should be located adjacent to the wash-house and, depending on the location, mechanical ventilation may be necessary for the removal of fumes and steam.

4.59 A wash-hand basin alongside a mirror and shelf with emergency eye-care items should be located in this area. A shower-head should also be provided for emergency purposes only with an immediate high volume output. Floor drainage needs to be provided.

Washing materials store

4.60 A lockable store for holding at least one month's supply of materials will be needed. Most of the materials will be in heavy bags of containers and should be stacked on a timber-slatted area. The store should have easy access to the unloading dock where delivery will usually be made and it should be located next to the solution preparation area. A pallet truck should be used to move the bags of washing materials to and from the store.

Machine clothing store

4.61 There should be a lockable store with adequate space to accommodate materials for completely re-clothing the calenders and presses and a month's supply of wrapping materials. Calender clothing is supplied in bales 1 x 1 x 1.7 m and is heavy. This necessitates direct external vehicular access for unloading, and a suitable location would be adjacent to the unloading dock.

Dry-cleaning chemicals store

4.62 This store is required for the storage of filter powder and "spotting" chemicals. It should have access from outside the building and should be permanently ventilated to the outside.

Plantrooms and associated areas

Calorifier and associated plantroom

4.63 This room should be used for the main steam entry to the laundry from the boilerhouse and for steam meters and headers with reducing set(s) for low-pressure steam services which might be required. It should be sited preferably on an outside wall and as near as possible to the centre of the steam load for the laundry in order to minimise the length of distribution mains.

4.64 All steam and condensate piping and the hot water cylinders in this plantroom should be adequately insulated. The room should have adequate permanent natural ventilation with low-level inlet grilles or louvres and high-level outlets. Special care must be taken to ensure that calorifier tube nests can be withdrawn. A lifting eye or beam can usually be provided for this purpose at low cost when the calorifier room is built. Sufficient clear space should be allowed round each item of equipment to facilitate maintenance and servicing. Entry to the calorifier room should preferably be from the outside of the building. Guidance on the capacity of the plant to be installed is given in Appendix 5. Reference should be made also to Hospital Service Engineering Data Sheets DN 2.1/2, 2.3/12 and 2.13/36 – 'Layout of calorifiers in plantrooms' and to Hospital Technical Memorandum (HTM) 23 – Access and accommodation for engineering services'.

Compressor room

4.65 The air compressors and receivers will be housed in this room. This equipment requires a large amount of natural ventilation and is noisy in operation. Because of these two factors the room may be sited away from the main envelope of the laundry.

Engineer's workshop/store

4.66 Large-scale repair work should be carried out in a works department or by specialist contractors. If minor repairs, servicing and testing are to be carried out, a work bench, racks for small tools and lockable cupboards for valuable tools and instruments will need to be provided. Storage facilities may be needed for stocks of essential spare parts. A wash-hand basin is to be provided.

Engineer's workshop/store – offsite laundry

4.67 Where a laundry is offsite, facilities for large-scale repair work should be provided. These will include separate work benches for mechanical and electrical work, racks for small tools, lockable cupboards for valuable tools and instruments, and storage facilities for stocks of spare parts. A wash-hand basin is to be provided.

4.68 An office may be required for the engineer. It should contain, as well as the usual office equipment, a locker for a change of clothing.

LV switchroom

4.69 The main electrical switchgear will be accommodated here, together with the distribution switch gear and metering and distribution fuseboards, (see HTM 2007 – 'Electrical services supply and distribution'). It should be designed to comply with the requirements of the Factories Act 1961 and the Memorandum on the Electricity Regulations (HMSO) to allow a clear passage in front of the switchgear. It should be kept dry and well ventilated and the door should be lockable.

Stand-by generator room

4.70 If a stand-by generator is provided, a room will be required in which to house it and the associated control panel. This equipment will require a large amount of natural ventilation. It is usually noisy in operation, and so the room should be well sound-insulated.

Storage tanks

Header tank

4.71 A header tank with adequate static head containing approximately one hour's storage of softened water will be required to supply washing machines. The tank may be supported by a structure above the softening plant or near the washing machines. To supply washing machines in soft water areas, a header tank with adequate static head containing approximately two hours' storage, will be required. The tank may be supported by a structure above or near the washing machines. The difference in storage capacity of this tank is due to the four hours' softened water storage giving a sufficient buffer in supply against the non-buffer draw-off from the water authority's mains, as it will not cope with the instantaneous demand that laundries will pose on these.

Water recovery header tank

4.72 A header tank with adequate static head and of sufficient capacity to contain the total quantity of the last usable rinse water from all washing plant, will be required to supply the washing plant with its first "breakwash" water. This tank may be supported by a structure above the plantroom or near the washing plant. An inspection cover must be incorporated to allow for regular cleaning and testing for bacterial contamination.

Heat recovery storage tank

4.73 A collection tank to contain the total quantity of usable hot effluent discharged from all washing plant, will be required, with an inspection cover to allow for regular cleaning and testing for bacterial contamination.

4.74 A storage tank/cylinder will be required with sufficient capacity to contain the total usable quantity of hot water from the heat exchanger.

Soft water plantroom – storage tank

4.75 Where water softening is to be carried out, storage tanks containing not less than four hours' storage (this will enable the softening plant to be optimally sized) should be provided complete with pumps to supply the softened water to the washing machines as well to the header tank. The capacity of the softened water storage and header tanks may be determined from the hourly water consumption tabulated in Appendix 6. It is now common practice to locate the larger soft water tanks at ground level. Where the tanks providing water storage for the laundry are supported by a tower to give the necessary pressure head, it may be more appropriate for base-exchange water softening plant to be accommodated beneath these tanks. The combination of this plantroom with the main plantroom should be considered on the basis of best utilisation of spaces and services.

Salt store – dry or solution

4.76 Where the base-exchange system of water softening is used, space will be required to store supplies of salt. The type of salt used will determine the siting, capacity and design of the store. Salt can be delivered either in bags or as a slurry to be stored in tanks; the scale of operation and the hardness of the water will influence the choice. The salt supplier should be consulted at an early stage on all technical matters involved, including position and size of store in relation to vehicular access and the design of any saturator tanks that may be required.

Solvent storage tank

4.77 The dry-cleaning solvent storage tank should be located outside the building and provide easy access to tanker vehicles delivering solvent. It should be sited as near to the dry-cleaning machine as possible, since the solvent must be piped directly into the machine, ensuring that it has no exposure at any time to the atmosphere. A bund should be provided to contain any accidental spillage of solvent. Ease of access to the tank for inspection and maintenance is required but the area should be secure, to prevent unauthorised entry.

Stand-by generator oil storage tank

4.78 This oil storage tank should be sited adjacent to the generator room and installed in accordance with the guidance given in HTM 2011 – Emergency electrical services' and appropriate fire regulations.

Facilities elsewhere

Storage facilities at sending hospitals

4.79 A secure holding bay is required at each collection point for dirty linen. The bay should be weatherproof and have ease of access for vehicles. A secure store for clean linen reception and distribution may be required, based on an average of 60 articles per staffed bed per week and an assumption of four days' storage of linen.

5.0 Engineering

Introduction

5.1 This chapter describes the engineering services contained within a laundry on a hospital site and how they integrate with the engineering systems serving the whole site.

5.2 This guidance should not inhibit the design solution, but should acquaint the engineering members of the multidisciplinary design team with the design criteria and material specification needed to meet the functional requirements.

5.3 Documents referred to by number, for example[10], are listed at the end of this chapter. They are numbered in order of first appearance. Each repeated reference retains the same number.

Model specifications

5.4 A series of model specifications, for specialised engineering services in healthcare buildings, has been issued nationally and is sufficiently flexible to meet local needs. The cost allowance is based on the qualities of material and workmanship described in the relevant parts of the model specifications.

Economy

5.5 Engineering services are a significant proportion of the capital cost and a continuing charge on revenue budgets. The project design engineer should therefore ensure:

a. economy in provision, consistent with meeting functional requirements and maintaining good standards;

b. optimum benefit from the total financial resources these services are likely to absorb during their lifetime.

5.6 Where alternative design solutions are available their consequential capital and running costs should be compared using option appraisal techniques[1].

5.7 The economic appraisal of alternative locations and design solutions should include heat conversion and distribution losses to the point of use. Where buildings are located remote from the development's energy centre, these losses can be significant.

5.8 Consideration should be given to energy management and facilities offered by a whole hospital control system, to enable some measure of energy accounting to be exercised.

5.9 Steam, cold water, electricity and gas should be metered.

5.10 In view of the increasing costs of generating heat energy, consideration should be given to the economics of appropriate equipment for recovering some of the energy which would otherwise be discharged by the mechanical ventilation system and water effluent. Feasible water recovery systems should also be considered. Further guidance is contained in Appendix 6.

Steam, water and electricity consumption

5.11 The estimated demand and storage requirement, where appropriate, for each engineering service, will need to be assessed individually to take account of the size, shape, geographical location, operational policies and intensity of use of the laundry. As a guide, and for preliminary planning purposes only, Appendix 5 provides an estimate of process steam, water and electricity consumption. Heating and ventilation consumption is excluded from the figure.

Activity data

5.12 There is no Activity data included within this Note because of the specialist nature of the equipment used in the laundry department. Manufacturers' advice should be sought.

5.13 A guide to the main items of plant in production areas is contained in Appendices 2 to 4.

Safety

5.14 Chapter 6 of the Health and Safety at Work etc Act 1974[2], as amended by Schedule 3 of the Consumer Protection Act 1987[3], and The Supply of Machinery (Safety) Regulations 1992 impose statutory duties on all persons who design, manufacture, import, supply, install or erect "articles for use at work". One of the requirements of this chapter is to ensure, so far as is reasonably practical, that the article is so designed and

constructed that it will be safe and without risks to health at all times when it is being set, used, cleaned or maintained by a person at work. All parts of engineering systems are covered by the term "articles for use at work". Reference should also be made to Safety in laundering guidelines[4] and Safety in dry cleaning guidelines[5].

Fire precautions

5.15 Design guidance for fire precautions is contained in Health Technical Memorandum (HTM) 81[6] and Laundries (Fire Practice Note 1)[7]. Technical information concerning the design and specification of fire detection and alarm systems is contained in HTM 82[8], which also replaces or modifies certain clauses of BS5839, Part I[9], to meet the needs of healthcare premises. More general advice on fire prevention, including the storage of flammable materials, is contained in HTM 83[10].

5.16 The design of the engineering services should accord with the recommendations in the above series of HTMs and the engineer should verify his proposals in accordance with the procedure described in paragraphs 3.25 to 3.28 of this Note.

Noise

5.17 Excessive noise, whether internally or externally generated and transmitted, can adversely affect the operational efficiency of the department and can cause discomfort. The limits and means of control advocated in Hospital Design Note4[11], including its revisions HN(76)126[12] and Engineering Data Sheet DH 1[13], should provide an acceptable acoustic environment. There will also be a need to ensure speech privacy in the manager's office, so that confidential conversation is unintelligible in adjoining spaces.

5.18 Laundry machines generate high levels of noise, and the cumulative effect can be considerable. It may be necessary, therefore, when ordering, to specify noise levels or attenuation measures.

Space for plant and services

5.19 Space for plant and services is important and the layout should provide:

a. easy and safe means of access, protected as far as possible from unauthorised entry;

b. space for frequent inspections and maintenance;

c. for eventual removal and replacement of plant.

5.20 Recommended spatial requirements for mechanical, electrical and public health engineering services are contained in HTM 23[14]. The information in this HTM is specifically intended for use during the initial planning stages when precise dimensional details of plant are not available.

5.21 The distribution of mechanical and electrical services to final points of use within office areas should be concealed in walls and above ceilings, but elsewhere services should not be enclosed.

Access to control and isolation devices

5.22 Primary distribution control and isolation devices should be:

a. located in circulation rather than working areas (office accommodation);

b. protected against unauthorised operation, for example switchgear and fuseboards should be housed in secure cupboards;

c. easily accessible for staff operation where appropriate.

Engineering commissioning

5.23 It is essential that engineering services should be fully commissioned. HTM 17[15] describes the requirements which should be included in the design and building contract documents. Flow measurement and balancing of systems requires adequate test facilities to be incorporated at the design stage.

MECHANICAL SERVICES

Heating (office and ancillary areas)

5.24 Space heating, within office and some ancillary areas, may be met by low-pressure hot water radiators supplied from a calorifier. They should be located under windows or against exposed walls, with sufficient clear space between the top of the radiator and the window sill to prevent curtains reducing the output. There should be adequate space below to allow cleaning machinery to be used. Where a radiator is located on an external wall, back insulation should be provided to reduce the rate of heat transmission through the building fabric.

5.25 To provide close temperature control within individual spaces, all radiators should be fitted with thermostatic radiator valves. These valves should be of robust construction and selected to match the temperature and pressure characteristic of the heating system. The system should have automatic "time-switch" control with manual and frost protection override.

Heating (production areas)

5.26 There will be little need for space heating in the calendering, drying and pressing areas, due to heat radiation from machines during the working day. However, to provide frost protection in these areas and general space heating elsewhere, low-pressure steam unit heaters or ventilation units with a fresh air/recirculation facility will usually be the most suitable method.

5.27 Fresh-air inlet unit heaters should have an automatic recirculation facility to maintain the minimum "set back" temperature of 5°C for frost protection.

5.28 The discharge from fresh-air unit heaters should be ducted to a suitable height and terminate with manual control dampers. The dampers should direct the air flow to high or low level as required by the operators.

5.29 The reception and dispatch areas may be heated by radiant panels.

5.30 All heating appliances should be easily accessible for cleaning and removal of lint and dust.

5.31 The system should have automatic "time-switch" control with manual and frost protection override.

Ventilation (general)

5.32 Mechanical ventilation systems can be expensive in terms of capital and running costs and planning solutions should be sought which take maximum advantage of natural ventilation. More detailed guidance is contained in BS5925:1991[16]. Guidance on mechanical systems is contained in BS5720:1979[17]. Separate extract systems will be required for sanitary accommodation and some equipment.

Ventilation (production area)

5.33 The production area ventilation system should be designed to supply fresh air to operator positions and to remove excess heat from equipment and processes. The supply should terminate with manual control dampers which enable the operator to direct the air flow to high or low level as required.

5.34 In winter months, the system should be designed for a minimum air-change rate to replace air extracted through equipment, provided this rate exceeds environmental requirements.

5.35 When assessing extract requirements, the extract rates of equipment should be taken into account when seeking to balance the supply against varying extract rates.

5.36 Mechanical extract fans in the calendering and garment finishing areas should be roof-mounted above the principal heat-emitting equipment. Extract fans in the sorting area should also be roof-mounted.

5.37 A ducted mechanical extract system serving the washing area should be located and sized to draw approximately one-third of the air across the laundry from the finishing area, thus providing heat in winter and reducing humidity.

5.38 To ensure reasonable working conditions in finishing areas when high ambient temperatures prevail in summer, the capacity of the extract fans, together with the air extracted by tumble-driers and calendars, should provide a maximum temperature differential of 7°C between inlet and extract air.

5.39 Tumble-driers, calenders and finishing units will usually have dedicated extract systems which take their supply air from within the building. There should be provision for cleaning these ducts, associated lint traps and heat recover units. Care must be taken to avoid distributing air-borne lint to adjacent roofs and gutters.

5.40 Simple mechanical extract arrangements will be required in the dry-cleaning room to remove fumes of perchlorethylene or other solvents. The extract should normally be taken from low level and discharge above the roof level of the laundry and adjacent buildings, away from windows and other air inlets.

Ventilation (controls)

5.41 The concentration of substances hazardous to health should be limited to the values contained in the Health and Safety Executive guidance[18], EH 40 'Occupational exposure limits'. Guidance is also contained in 'The Control of Substances Hazardous to Health'[19].

5.42 External discharge arrangements for extract systems should be protected against back pressure from adverse wind effects. They should be located to avoid reintroduction of exhausted air into this or adjacent buildings, through air intakes or windows.

5.43 Safe access to roof ventilation units should be provided for maintenance and replacement.

5.44 Ventilation supply plant should include air filters having a minimum arrestance of 85% when tested in accordance with BS EN 779[20]. They must be readily accessible for replacement and should be provided with a pressure-differential indicator.

5.45 Extract and supply fans should be individually switched and have a red indicator lamp on the control

panel to show when the fan is running. The controls for all fans serving principal sections of the ventilation system can be grouped in a console to facilitate the operation and adjustment of the ventilation in a given area.

Hot and potable cold water services

5.46 Guidance on the design and installation of cold-water supply pipework and distribution systems is contained in HTM 27[21]. All cold-water pipework, valves and flanges should be insulated and vapour-sealed.

5.47 Guidance on the control of legionellae in healthcare premises is contained in HTM 2040[22] and in the Health and Safety series booklet HS(G)70[23].

5.48 The outflow temperature from the calorifier should be 60°C ± 2.5°C. The return temperature to the calorifier should not be less than 50°C.

Cold water (production area)

5.49 There must be an adequate supply of cold water, and this will usually require the provision of a supply which is separate from that of the remainder of the hospital complex. The total storage capacity will depend on the requirements of the water supply authority and limitations on the source. See also the European Standard EN 50084 – 'safety of household and similar electrical appliances – requirements for the connection of washing machines, dishwashers and tumble driers to water mains'. A minimum of four hours' consumption should be stored at high level.

5.50 Where water-softening plant is installed, storage equivalent to four hours' supply will normally suffice. Storage and treatment plant sizes are inversely related and, therefore a duplex base-exchange system, which provides a continuous supply of treated water, can lead to a reduction in storage capacity, or vice-versa, and can also provide an element of stand-by.

5.51 Hosing-down points with water at suitable pressure will be required in the main wash areas.

Hot water (production area)

5.52 The temperature and quantity of hot water will depend on the type of washing system employed. It may be generated in the laundry by gas-fired units or by a calorifier supplied by flash steam or steam from the hospital.

Steam and condensate service

5.53 Steam, when available from the hospital system, should be supplied at a pressure of not less than 10 bar. Otherwise, the laundry should have independent steam generating plant. The steam supply may be required for washing machines and will need to be selected to suit peak demand. Reducing valves should be selected and matched to the load to ensure satisfactory performance over a wide load range.

Compressed air

5.54 Compressed air is used extensively for equipment such as presses, hoists, automatic controls, for washing machines and for cleaning points adjacent to machinery. The project team may wish to consider refrigerated air driers to assist the optimum use of equipment. The air intake should be located outside the building and should be fitted with a silencer and filter. Oil-free air at a pressure of 7 bar should be provided by two compressors, duty and stand-by. The capacity of each can only be determined after the laundry equipment has been selected. Further guidance on sizing and system design is contained in Engineering Data Sheet DT 1[24].

ELECTRICAL SERVICES

General scope

5.55 The electrical installation should comply in all respects with the current IEE Regulations for Electrical Installations[25] and conform to the requirements of HTM 2007[26].

5.56 The point of entry for the electrical supply will be a switchroom housing the main isolators, with provision for metering and distribution equipment. The switchroom will also be the distribution centre for subsidiary electrical services. Wherever possible, all equipment should be mounted at a suitable height to give easy access from a standing position. The switchroom should be positioned so as to minimise the cost of cabling throughout the laundry. Switchgear should be lockable in the off position.

Electrical installation

5.57 The electrical installation in occupied ancillary areas should be concealed, usually using PVC-insulated cable in screwed-steel conduit or trunking but, in certain circumstances, mineral-insulated copper-covered cables may be necessary. External installations should consist of PVC-insulated cables in galvanised screwed-steel conduit with fittings of weatherproof pattern. Steel conduit and

trunking wireways for communication systems should also be concealed wherever possible.

Electrical interference

5.58 Guidance concerning the avoidance and abatement of electrical interference is contained in HTM 2014[27]. Fluorescent luminaires should comply with BS5394[28].

5.59 Care should be taken to avoid mains-borne interference and electrical radio frequency interference affecting computers and other electronic equipment used here or elsewhere on the site.

Lighting

5.60 Practical methods of lighting the various spaces are contained in the CIBSE Lighting Guide LG02[29]. Luminaires should be manufactured and tested in accordance with the requirements specified in the relevant sections of BS4533[30]. Their location should be readily accessible for lamp changing and maintenance, but with the overriding requirement that the recommended standard of illuminance is provided to the task area. Luminaires using fluorescent lamps should be installed in office and ancillary areas. Metal halide lamps should be used in production areas. Luminaire types and sizes should be rationalised to simplify maintenance and minimise stocks of replacement lamps.

5.61 Control of lighting is normally by local switches and these should be provided in sufficient numbers to allow variation in lighting options, for example reduced levels of illuminance when circumstances permit, to encourage energy conservation. This is particularly relevant in rooms where, because daylight is restricted, supplementary artificial lighting is required for long periods in areas remote from windows. However, it is important that excessive contrast with adjacent areas should be avoided.

Corridor lighting

5.62 The lighting of corridors, stairways and other circulation areas, which generally are areas not covered by Activity DataSheets, should be in accordance with the guidance contained in HBN 40, Volume 2[31] and Volume 3[32].

Lighting (computer terminals)

5.63 In areas where computer terminals are to be used, the lighting should be designed to avoid bright reflections on the screen and to ensure that the contents of the screen are legible. Further guidance can be found in CIBSE Lighting Guide LGO3[33].

Socket outlets and power connections

5.64 Sufficient 13 amp switched shuttered socket-outlets, connected to ring or spur circuits, should be provided to allow all portable appliances likely to be used simultaneously to be individually supplied. The installation of twin outlets should be considered where these activities occur in juxtaposition.

5.65 Domestic cleaning appliances are assumed to have 9 m flexible leads. Socket-outlets, usually in corridors, should be provided to enable such machines to operate.

5.66 Fixed appliances, rated up to 13 amps, should be permanently connected to double pole switched spur boxes and fused as required. Appliances rated in excess of this load, or those requiring a three-phase supply, should be permanently connected to separate final circuits from fuseboards and independently switched at a local isolator of appropriate rating.

5.67 Local switched or other means of electrical insulation should be provided adjacent to plant and equipment to ensure the safety of operators and maintenance staff.

5.68 Heating appliances and automatically operated equipment should be provided with indicator lights to show when the equipment is energised. Such indicators should be incorporated in the control panel of the apparatus, in the control switch or the socket-outlet from which the apparatus derives its supply.

Emergency electrical supplies

5.69 Guidance concerning the provision of emergency electricity supplies is contained in HTM 2011[34]. Safety lighting, in accordance with HTM 2011 and BS5266[35], should be provided on primary escape routes.

5.70 The stand-by generator, if required, should be capable of supporting 50% of the laundry's normal production.

5.71 In the event of a power failure, appropriate equipment and lighting should be automatically transferred to emergency supplies.

Wireways for telephones and data links

5.72 Central telephone facilities for internal and external calls will normally be available and should be extended to

serve this department. A pay phone should also be provided.

5.73 Guidance concerning the provision of telephone services, including the telephone internal cabling distribution and telephone handsets, is contained in HBN 48[36].

Electric clocks

5.74 Clocks should operate in conjunction with a master clock system. If such a system is not available, synchronous clocks should be installed using a common clock circuit suitable for future connection to a master system.

5.75 A time-recording clock and rack will be required adjacent to the staff entrance.

Radio/loudspeaker system

5.76 The radio relay system may be supplied via the hospital communal aerial installation and central amplification equipment.

5.77 There should be facilities for relaying music. The control unit, which can also be equipped as a staff call system, can be located in the manager's office or the general office. The system should ensure that staff messages are audible against the background of extraneous noise.

Lightning protection

5.78 Protection against lightning should be provided in accordance with HTM 2007[26], HSE Data Sheet DB 2[37] and BS6651[38].

INTERNAL DRAINAGE

General scope

5.79 The design should provide an internal drainage system which:

a. uses the minimum of pipework;

b. remains water- and air-tight at joints and connections;

c. is sufficiently ventilated to retain the integrity of water seals.

Design parameters

5.80 General design guidance is contained in the relevant British Standards and Codes of Practice, including BS5572[39] and the current Building Regulations. Recommendations regarding spatial and access requirements for public health engineering services are contained in HSE Data Sheet EA 5[40].

5.81 The gradient of branch drains should be uniform and adequate to convey the maximum discharge to the stack without blockage. Practical considerations, such as available angles of bends/junctions and their assembly, as well as space considerations, usually limit the minimum gradient to about 1:50 (20 mm/m). For larger pipes, for example 100 mm diameter, the gradient may be less, but they will require workmanship of a high standard if adequate self-cleansing flow is to be maintained.

Operational considerations

5.82 Maintenance problems may arise as a result of misuse, for example disposal of paper towels. Appropriate disposal facilities, therefore, should be provided. Warm-air hand driers may provide a solution.

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(28) **BS5394: 1988** Specification for limits and methods of measurement of radio interference characteristics of fluorescent lamps and luminaires.

(29) **CIBSE Lighting Guide LG02. Hospitals and health care buildings.** Chartered Institution of Building Services Engineers, 1989. ISBN 0900953373.

(30) **BS4533:** Luminaires.

(31) **Common activity spaces (HBN 40):**

Vol 2 – Corridors. Department of Health, HMSO 1986. ISBN 0113210485.

(32) **Common activity spaces (HBN 40):**

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6.0 Cost information

Introduction

6.1 For all types of health buildings it is clearly of vital importance that building and running costs should be kept as low as possible consistent with acceptable standards. Within this general context Health Building Notes provide a synopsis of accommodation for health buildings which the Department, in conjunction with the National Health Service, recommends for the provision of a given service.

Works cost

6.2 To prepare an estimate of the works cost for a scheme, reference should be made to the Capital Investment Manual. The total cost allowance for a scheme is derived by aggregating the cost of the functional units and optional accommodation and services (OAS) as appropriate to the particular scheme.

6.3 The cost allowances cover the building and engineering requirements set out in this Note. In costing the functional units it has been assumed that they will be combined to form a complete laundry on a hospital site. If the laundry is not on a hospital site, accommodation such as a boilerhouse and engineer's accommodation will be needed.

6.4 The costing of the functional units assumes that the linen will be organised on a "pooled" basis (see paragraph 4.42), and that it will be wrapped before being dispatched to the sending hospitals (see paragraph 4.44).

Functional units

6.5 The functional units for this Note are:

Laundry

55,000, 100,000, 150,000 and 200,000 articles per week

Water softening

55,000, 100,000, 150,000 and 200,000 articles per week

Dry cleaning

600, 800 and 1,100 articles per week

Patients' personal clothing

3,500, 5,000, 7,000 and 14,000 articles per week

Storage at sending hospital

300, 400, 500 and 600 beds

Engineer's accommodation

The activity spaces and areas used for costing the functional units are listed in the Schedules of Accommodation at the end of this chapter.

Laundry

6.6 This consists of the main production area together with the necessary staff and support services.

Water softening

6.7 In hard water areas, water-softening plant will be required.

Dry-cleaning section

6.8 Production and storage areas are provided. It is envisaged that this section will be within the main laundry production area.

Patients' personal clothing area

6.9 Washing, drying and finishing areas are provided. It is envisaged that this service will form a part of the main laundry production line.

Storage facilities at sending hospital

6.10 Provision is made for the separate storage of clean and soiled linen.

Engineer's accommodation

6.11 When the laundry is not on a hospital site it will be necessary to provide accommodation additional to the engineer's workshop/store. This accommodation provides for an engineer's office and a workshop-store suitable for large-scale repair work.

Optional Accommodation and Services (OAS)

6.12 Where appropriate, this Note draws attention to alternative ways of providing services or facilities, including the likely cost implications. The information will allow project teams to select the solution which is most suitable to their needs. The OAS costed in this Note is listed in the Schedules of Accommodation at the end of this chapter.

Dimensions and areas

6.13 In determining spatial requirements, the essential factor is not the total area provided but the critical dimensions, that is those dimensions critical to the efficient functioning of the various activities. To assist project teams in preparing detailed design solutions for the rooms and spaces, studies have been carried out to establish dimensional requirements in the form of critical dimensions. The results of these studies appear as ergonomic diagrams in HBN 40 – 'Common activity spaces', Vols 1–4.

6.14 For development planning and at the earliest stage of a design it may be convenient for designers to have data available which will enable them to make an approximate assessment of the sizes involved. For this reason the areas prepared for the purpose of establishing the cost allowances are included at the end of this chapter.

6.15 It is emphasised that the areas published **do not** represent recommended room sizes, nor are they to be regarded in any way as specific individual entitlements.

Circulation

6.16 Space for circulation, which includes allowances for planning provision, an engineering zone adjacent to the external walls, small ducts and partitions, has been added to each functional unit and is included in the cost allowances.

Communications

6.17 Staircases and lifts are not included in the cost allowances. Dedicated plantrooms, tank rooms and electrical switchrooms are included, and are not considered to be communications space.

Engineering services

6.18 The following engineering services as described in Chapter 5 are included in the cost allowances. Primary engineering services are assumed to be available at the boundary of the department unless otherwise indicated.

a. Mechanical services

Heating:	thermostatically controlled low-pressure hot water radiators in offices and staff areas (calorifiers included). Radiant panels in reception and dispatch areas. Steam unit heaters elsewhere;
Ventilation:	mechanical supply, including steam heaters and controls, and extract units. Ventilation plan included;
Cold water:	potable system to service points, including storage;
Soft water:	soft water supply, including storage (4 hours) an distribution system to machines. A separate cost allowance is provided for water-softening plant if required;
Hot water:	hot water service to machines, from and including calorifiers;
Domestic hot water:	supplied from electric heaters adjacent to service points;
Steam:	steam and condensate system supplied from hospital service;
Compressed air:	compressed air system, including compressors;
Wash chemicals:	mixing, storage and injection system to washing machines;
Fire protection:	supply including hosereels;
Effluent water heat recovery:	heat recovery system comprising: heat exchanger for batch continuous washer on 100,000, 150,000 and 200,000 piece sizes. Heat recovery pit for washer-extractor on 55,000 piece size;

Air heat recovery:	heat recovery system comprising: plate heat exchanger for tumble-driers and tunnel finisher. End-point detection for tumble-driers;

b. Electrical services

Switchboard:	departmental distribution switchboard and meters;
Lighting:	general lighting as required by tasks. Fluorescent, metal halide, safety and emergency luminaires as appropriate;
Power:	power supplies to Groups 1 and 2 equipment and to mechanical services. Socket outlets and equipotential earth-bonding connections;
Emergency electrical services:	stand-by and safety installations from hospital service;
Fire alarms:	fire alarm system;
Clocks:	impulse clocks;
Inter-communication:	radio programme distribution and staff call system;
Telephones:	telephone and data transmission wireways (telephone wiring included);

c. Equipment (Group 1)

Production:	equipment as in Appendix 2, plus, monorail system, marking machine, towel folder, conveyors, weighing, wash chemical, mixing tank, soiled classifier;
Dry cleaning:	Equipment as in Appendix 3;
Patients' personal clothing:	Equipment a in Appendix 4.

Schedules of Accommodation

Schedule 1 Laundry

Para no	Activity space	Articles per week 55,000 Qty	55,000 Total area (m²)	100,000 Qty	100,000 Total area (m²)	150,000 Qty	150,000 Total area (m²)	200,000 Qty	200,000 Total area (m²)
Production area									
4.04	Dirty linen reception	1.0	210.00	1.0	330.00	1.0	512.00	1.0	650.00
4.19	Wash/dry/finish incl. infected linen	1.0	440.00	1.0	650.00	1.0	1,020.00	1.0	1,240.00
4.35	Linen repair and marking room	1.0	30.00	1.0	50.00	1.0	80.00	1.0	100.00
4.41	Assembling and packing area	1.0	140.00	1.0	230.00	1.0	364.00	1.0	440.00
4.46	Central linen store	1.0	40.00	1.0	63.00	1.0	85.00	1.0	85.00
4.47	Condemned linen store	1.0	5.00	1.0	5.00	1.0	5.00	1.0	5.00
4.48	Trolley store and dispatch	1.0	60.00	1.0	80.00	1.0	116.00	1.0	180.00
Offices and staff accommodation									
4.49	Main entrance and lobby	1.0	12.00	1.0	18.00	1.0	20.00	1.0	24.00
4.50	Manager's office	1.0	15.00	1.0	15.00	1.0	15.00	1.0	15.00
4.50	Assistant manager's office	1.0	12.00	1.0	12.00	2.0	24.00	2.0	24.00
4.50	General office	1.0	15.00	1.0	21.00	1.0	27.00	1.0	30.00
4.50	Supervisor's office	1.0	7.00	1.0	7.00	1.0	9.00	1.0	9.00
4.51	Staff changing: male	1.0	16.00	1.0	24.00	1.0	32.00	1.0	40.00
4.51	Staff changing: female	1.0	25.00	1.0	38.00	1.0	50.00	1.0	63.00
4.54	Staff room and kitchen	1.0	27.00	1.0	41.00	1.0	54.00	1.0	68.00
4.55	First aid room	1.0	7.50	1.0	7.50	1.0	7.50	1.0	7.50
4.56	Cleaners' room	1.0	7.00	1.0	7.00	1.0	7.00	1.0	11.00
4.68	Engineer's Office	1.0	7.00	1.0	7.00	1.0	7.00	1.0	7.00
Stores and supplies									
4.58	Solution preparation	1.0	55.00	1.0	70.00	1.0	83.00	1.0	83.00
4.60	Washing materials store	1.0	12.00	1.0	15.00	1.0	15.00	1.0	20.00
4.61	Machine clothing store	1.0	12.00	1.0	12.00	1.0	20.00	1.0	20.00
–	Water storage	1.0	20.00	1.0	30.00	1.0	48.00	1.0	60.00
–	Materials store	1.0	15.00	1.0	25.00	1.0	38.00	1.0	38.00
Plant rooms and associated areas									
4.63	Calorifier and associated plant room	1.0	20.00	1.0	25.00	1.0	35.00	1.0	45.00
4.65	Compressor room	1.0	10.00	1.0	18.00	1.0	18.00	1.0	25.00
4.66	Engineer's workshop/store	1.0	14.00	1.0	14.00	1.0	20.00	1.0	25.00
4.69	LV switchroom	1.0	15.00	1.0	20.00	1.0	20.00	1.0	24.00
	Nett total		1,248.50		1,834.50		2,731.50		3,338.50
	Circulation etc		247.00		325.00		484.00		486.00
	Total		**1,495.50**		**2,159.50**		**3,215.50**		**3,824.50**
	Departmental areas		1,495.00		2,160.00		3,215.00		3,825.00 sq m

Schedule 2 Patients' personal clothing

Para no	Activity space	Articles per week							
		3,500		5,000		7,000		14,000	
		Qty	Total area (m^2)	Qty	Total area (m^2)	Qty	Total area (m^2)	Qty	Total area (m^2)
4.26	Washing, drying and finishing	1.0	35.00	1.0	42.00	1.0	59.00	1.0	100.00
	Nett total		35.00		42.00		59.00		100.00
	Circulation etc		4.50		5.50		7.50		13.00
	Total		**39.50**		**47.50**		**66.50**		**113.00**
	Departmental areas		40.00		50.00		65.00		115.00 sq m

Schedule 3 Storage facilities at sending hospital

Para no	Activity space	Number of beds at hospital							
		300		400		500		600	
		Qty	Total area (m^2)	Qty	Total area (m^2)	Qty	Total area (m^2)	Qty	Total area (m^2)
4.79	Clean linen reception and distribution	1.0	44.00	1.0	70.00	1.0	80.00	1.0	90.00
4.79	Dirty linen	1.0	24.00	1.0	30.00	1.0	40.00	1.0	50.00
	Nett total		68.00		100.00		120.00		140.00
	Circulation etc		9.00		13.00		16.00		18.50
	Total		**77.00**		**113.00**		**136.00**		**158.50**
	Departmental areas		75.00		115.00		135.00		160.00 sq m

Schedule 4 Engineer's accommodation – offsite laundry

Para no	Activity space	Qty	Total area (m^2)
4.67	Engineer's workshop/store	1.0	47.00
4.68	Engineer's office	1.0	10.00
	Nett total		57.00
	Circulation etc		10.50
	Total		**67.50**
	Departmental area		70.00 sq m

Schedule 5 Water softening

Para no	Activity space	Articles per week 55,000 Qty	Total area (m^2)	100,000 Qty	Total area (m^2)	150,000 Qty	Total area (m^2)	200,000 Qty	Total area (m^2)
4.75	Plant room	1.0	8.00	1.0	9.00	1.0	11.00	1.0	13.00
4.76	Salt store – dry or solution	1.0	8.00	1.0	9.00	1.0	14.00	1.0	18.00
	Nett total		16.00		18.00		25.00		31.00
	Circulation etc		2.00		2.00		3.00		4.00
	Total		**18.00**		**20.00**		**28.00**		**35.00**
	Departmental areas		20.00		20.00		30.00		35.00 sq m

Schedule 6 Dry-cleaning section

Para no	Activity space	Articles per week 600 Qty	Total area (m^2)	800 Qty	Total area (m^2)	1,100 Qty	Total area (m^2)
Qty	area(m2)						
4.31	Production area	1.0	45.00	1.0	60.00	1.0	85.00
4.62	Chemicals store	1.0	6.00	1.0	6.00	1.0	6.00
4.77	Solvent storage tank	1.0	2.50	1.0	2.50	1.0	2.50
	Nett total		53.50		68.50		93.50
	Circulation etc		7.00		9.00		12.50
	Totals		**60.50**		**77.50**		**106.00**
	Departmental areas		60.00		80.00		105.00 sq m

Schedule 7 Optional Accommodation and Services (OAS)

Para no	Activity space	Space area (m^2)	Circulation etc (m^2)	Total area (m^2)
4.30	Personal clothing reception and dispatch	32.00	4.50	36.50
4.36	Theatre linen preparation	80.50	15.00	95.50
4.53	Uniform fitting	10.00	1.50	11.50
4.70	Stand-by generator	60.00	10.00	85.00
4.78	Oil store	15.00		

7.0 Activity data

There is no Activity data included within this Health Building Note, owing to the specialist nature of the equipment used in the laundry department. Manufacturers' advice should be sought.

Appendix 1

Laundry plant and equipment

1. Since the revised 1977 edition of this Note there have been various developments in laundry equipment and procedures that affect choice of equipment. The major change has been in washing equipment: the development of the continuous batch tunnel washer. There have been changes in workload and the proportions of different classifications, and an increase in the weight per article. Fabric development and the increasing use of polyester cotton has led to new and more economical methods of processing through equipment developed specifically for finishing polyester cotton.

2. Because of the development of equipment incorporating higher technology, with consequent increased purchase cost it is essential in the planning stages to have as much information as possible. This should relate to the workload in terms of fabric types, number of pieces and weight, broken down into classifications and finishing route, for example calendering, tunnel finishing, pressing, dry folding, or dry cleaning. Only when there is a sound knowledge of the quantity of work passing through each finishing department can:

a. the plant capacities be determined and balanced one to the other;

b. value for money be obtained;

c. labour-saving benefits accrue.

3. The final choice of equipment should be made on the basis of the precise requirements of the particular project, and close study of all relevant factors. The following points should be particularly considered:

a. suitability for its purpose, with special reference in the case of washing plant to the type of fabric to be processed and to fulfilment of the medical requirements for disinfection procedures;

b economy of resource, reduction of manual effort and continuity of workflow;

c. economy in the consumption of water, total energy, wash materials and other consumable items;

d. reasonable capital costs which should be confirmed by the use of total cost techniques (capital and revenue);

e. efficiency (under normal working conditions);

f. suitability for the application of automatic and mechanical aids;

g. reliability of design and construction, compliance with British Standards as appropriate, the provisions of the Health and Safety at Work etc Act 1974 and all other appropriate regulations;

h. ease and frequency of maintenance and availability of spare parts;

j. satisfying the requirements of the Factories Act, especially in respect of adequate safety arrangements by way of guards around moving parts of machinery.

4. It is not normally necessary to make provision for the failure of any individual item of main laundry production equipment. Loss of capacity caused by such failures and partial failures of services can be made up by overtime working.

5. Details of the main items of equipment for which allowance should be made during the initial planning stage, for laundries processing from 55,000 to 200,000 articles per week, are included in this Appendix.

Washing plant

6. It is not possible in this Note to provide a detailed survey of all types and varieties of washing systems which include:

- **washer-extractors**

  Side; top- and end-loading machines have the advantage of combining the operations of washing, rinsing and extraction without transfer, They may be coupled to water recovery systems and arranged for sequence operation.

- **batch continuous washing machines**

  These incorporate a contraflow system and comprise a number of washing units integrated to permit progressive and automatic mechanical transfer of their loads through a series of washing and rinsing operations. These machines incorporate automatic loading and unloading. They may be operated either in conjunction with separate extractors or may be equipped with integral extractors designed for automatic loading and unloading.

- **batch continuous tunnel washing machines**

  A batch continuous washing machine is simply a conventional batch continuous tunnel washer with a batch exchange facility incorporated.

7. The washing plant of a particular laundry will include more than one type of machine; the choice will be based on the most economic and practical solution for the classification handled by each principal section of the workflow, namely large flat-work, small flat-work, tumble-dry, pressing or steam/air finishing.

8. The capacity of individual washing units should be selected with due regard to the size and rate of output of each main classification and the corresponding sub-classifications where these occur. To avoid the possibility of serious disruption of laundry services in the event of major breakdown of plant, it is prudent not to rely on one large-capacity wash unit for bulk work but to install two or more units to provide the required capacity.

9. This Note provides for continuous washing units together with tipping washer-extractors for bulk washing.

10. Washing plant should be of stainless-steel construction for those parts which will be in contact with textiles being processed. All other parts of the machine which might be subject to corrosion by wash liquors, washing materials or condensation, should be of stainless steel or other suitable corrosion-resistant materials or treated to provide an effective resistance to corrosive attack.

11. When assessing the suitability of both conventional and more recently developed washing systems, every care must be exercised to ensure that the chosen system meets the clinical requirements for thermal disinfection.

12. A true comparison of the combined capital and running costs of various complex systems can be obtained only if in each case equivalent processing equipment is included so that in terms of labour, consumption of water, energy and materials, like is compared with like.

Washing machines

13. The conventional end-loading rotary washing machines continue to be economic and convenient for small classifications. For bulk washing they are being replaced by larger and more sophisticated washing units which differ both in concept and degree of automation from the conventional machines.

14. It is no longer possible to consider all washing machines as separate entities because often they are part of a multiple process unit. Such units range between a group of washer-extractors, and large-capacity continuous batch transfer machines integrated with water extraction, and drying (conditioning) tumblers which minimise the need for manual handling between the various operations.

15. Washing machines must be capable of washing without imposing undue strain or wear on fabrics. They should provide a rinsing efficiency sufficient to ensure that the net alkalinity of the effluent extracted from the articles after the final rinse is less than 10% of the net washing alkalinity, always provided that the gross alkalinity of the extraction effluent does not exceed approximately 300 mg/litre expressed in terms of $CaCO_3$. Provision of entry ports in washing machines for wash chemicals will take advantage of modern delivery methods.

16. Although the use of woollen materials in the great majority of hospitals has almost ceased, it may still be necessary to provide at least one washing machine with two-speed drive and interrupter gear for processing woollen blankets. It could also be used for sheepskins.

17. Where machines are designed to transfer the articles from one part of the process to the next, this action should be possible with the minimum of trouble and manual attention. When comparing various washing machines consideration should be directed to such matters as tendency to "roping" during the washing process, the possible need to "sour" where residual alkalinity after rinsing is too high, and the moisture content of fabrics after extraction. **Batch process machines** usually consume power and materials related to the size of a batch. **Continuous processing machines** may consume both power and materials irrespective of high or low rates of laundry throughput, and to obtain the maximum benefit from them they should be continuously operated at their optimum rate of production. A disadvantage of batch processing is the fluctuating demand on supplies of water, steam and power. This disadvantage is largely eliminated with a continuous washing plant which, by its nature, requires a continuous and steady supply of water, washing materials and energy in all its forms.

18. The sizing of a tunnel washing machine demands accurate information if the process is to be adequate for its purpose. The number of tumble-driers associated with the "wash line" should be sufficient to condition and fully dry the loads passing through the line without the tumblers holding up the line due to insufficient capacity.

19. The equipment suggested is based on average workloads of 75% of the total quantity, with no account taken of the size, height etc of the machines available. Different sites may require different configurations because of space or difference in workload. Modern tunnel washers are also capable of processing almost the whole of a hospital workload, and if this decision was taken adjustments in size to those suggested would be necessary from those given in Appendix 2.

20. A simple guide for calculating the number of stages required for a tunnel washer is as follows:

a. from the manufacturer's brochure obtain the load size: usually 36 or 50 kg;

b. from the manufacturer's brochure obtain the overall process time per load, say 27 minutes. 60/27 loads per hour equals 2.2 loads per hour. Hence a 36 kg machine with an overall process time of 27 minutes would process 79.2 kg per hour (36 x 2.2). Similarly, a 50 kg machine would process 110 kg per hour;

c. estimate the total workload per week in kg and divide it by the number of working hours per week and by the machine utilisation factor if it is less than unity;

d. divide the answer obtained in c. above either by 79.2 for a 36 kg machine with 27 minutes process time or by 110 for a 50 kg machine with 27 minutes process time, and round up the answer to the next whole number.

For example, the estimated throughput of a proposed laundry is 39,000 kg per week. The laundry is in operation for 39 hours per week and the machine utilisation factor is 0.9. The overall process time for the tunnel washer is 27 minutes. Calculate the number of stages required for a tunnel washer if the load size is:

(i) 36 kg

(ii) 50 kg

(i) For a 36 kg load
number of stages $= 39{,}000/39 \times 0.9 \times 79.2$
$= 14.03$
$= 15.$

(ii) For a 50 kg load
number of stages $= 39{,}000/39 \times 0.9 \times 110$
$= 10.10$
$= 11$

21. Calculate machine time cycle

60 mins

33 (15 sections × 2.2 loads/hr) = 1.8 min cycle or stage time

24.2 (11 sections × 2.2 loads/hr) = 2.5 min cycle or stage time

22. Process considerations

36kg

3 stages pre-wash @ 1.8 min	=	5.4 min
7 stages hot wash @ 1.8 min	=	12.6 min
5 stages rinse @ 1.8 min	=	9.0 min
		27.0 min

or 50 kg

2 stages pre-wash @ 2.5 min	=	5.0 min
5 stages hot wash @ 2.5 min	=	12.5 min
4 stages rinse @ 2.5 min	=	10.0 min
		27.5 min

The above simulates an average washer-extractor process, with the exception of rinsing which is both longer and necessary as there is no interspin or extract within the tunnel washer.

Disinfection washing process

23. The type of washing plant suitable for the disinfection area should be dedicated washer-extractor(s) with their drain(s) sealed to prevent any aerosol effect into the laundry, and which drain directly into the interception pit of the main drain.

24. All washing plant should provide a washing process which includes a disinfecting stage in which the temperature for the whole load is maintained at 65°C for 10 minutes or 71°C for 3 minutes. For small machines of conventional design and degrees of loading, 4 minutes should be added to these times to allow for "mixing time". For large-capacity machines or heavy degrees of loading it may be necessary to add up to 8 minutes for "mixing time". "Mixing time" is regarded as the time taken to reach 95% complete mixing of detergent with the load and to reach the required temperature, calculating from the time at which the detergent is introduced into the washing machine. The importance of temperature in disinfection procedures requires machines to be provided with reliable thermometers, preferably of the mercury in steel type with the sensing element immersed in a position which will not give a false reading. Continuous washing machines, and other machines of new design which incorporate new washing processes, should be considered individually to determine satisfactory thermal disinfecting conditions for each type and to ensure that there is no possibility of any re-contamination after the disinfection stage. Thermal disinfection of the cool end of continuous washing machines must be carried out before the processing of linen is commenced at the start of the working day.

Automatic controls

25. Washing machines of the batch continuous tunnel type have automatic process controls and supply systems suited to their particular design. Washer-extractor machines should be equipped with automatic process control. Two types in particular of the many automatic controls have proved suitable for hospital laundries. One is a time-based control which needs water supply at a constant head. The other is mainly operated by a volumetric control system. Both usually rely on control of the steam supply by thermostat and some designs delay the timing of different parts of the washing and rinsing process until the correct quantity of water has entered the machine or until the required temperature has been reached. The delay system is of particular value in ensuring that the necessary temperature–time relationship for

disinfection during part of the washing process is achieved. Both types of automatic controls normally require supplies of washing materials in liquid form. Such supplies normally need facilities for mixing and storage for stock solutions. For some controls the position of solution tanks and their static head is important. The automatic washing controls of a series of washer-extractors should incorporate a sequencing device which will promote successive loading and unloading of all machines and at the same time minimise peak demand for water, steam and electric power.

Heat and water recovery systems

26. It is anticipated that the cost of water will rise and consideration should be given to the provision of heat and water recovery systems. These systems should be located near the washing plant and be convenient for the discharge of effluent to the sewers. Where recovery tanks are below the laundry floor level, their depth should be kept to a minimum to avoid the need for pumping effluent into sewers and to minimise the hydraulic lift for any other pumping purposes. Tanks used for recovery systems should be designed so that they may be emptied completely, and can be readily cleaned from scum and solid material which may accumulate at the bottom. There must be proper access for cleaning, and the provision of duplicate recovery tanks should be considered if the design of the system does not permit easy and rapid cleaning outside the normal working hours of the washing plant. Any water recovery system should have the facility for ensuring that the water returned to the laundry must be bacteria- and chemical-free. Recovery tank sizes will depend on the type of washing system with which they are associated. Effluent from washing machines in the disinfection area must not be connected to a water recovery system. Recovered water from other washing machines, however, may be used for sluicing and washing in this area.

Extractors

27. After washing, surplus water may be removed from textiles by hydraulic press, membrane press, or centrifuged in the washer-extractor. The hydraulic press or membrane press can be single- or dual-stage. Where synthetic textiles are used a single-stage membrane press is preferred.

28. The method of transfer from membrane or hydraulic press systems is by conveyor on to a shuttle conveyor to the conditioning plant.

29. The open areas around continuous batch tunnel washing systems must be totally enclosed by a mesh fence 2 m high. Measures must be taken to ensure there is no possible access route between or underneath equipment. Entry for maintenance, retrieval of dislodged linen and membrane press should be by gates which are interlocked to stop both the press and shuttle conveyor.

30. Where it is deemed necessary to bypass the drying stage, the take-off point should be suitably guarded.

Conditioning plant

31. To enable high rates of production to be obtained from flat-work ironing machines, calenders, pressing machines and other finishing units, it is often necessary to further reduce the moisture retained by articles after mechanical extraction and to break up the compacted loads from extractors into individual articles. This process is known as conditioning.

32. Conventional tumble-driers for this interprocess operation have been replaced by purpose-built conditioners. All have means for automatic loading and unloading of articles. Where tumble heater batteries and head exchangers are at high level, a gantry for easy access for maintenance may be required. Good insulation of the outer casing of these machines is necessary to minimise radiation of heat.

33. When assessing the total evaporative requirements of conditioning plant, consideration has to be given to the proportion of residual moisture which results from the various types of extractors. The residual moisture content of cotton fabric after centrifugal action is normally 50% or less of its bone-dry weight. The residual moisture content is normally between 30% and 60% after extraction by a membrane press, depending on type of press and type of linen.

34. Tumbler calculations

a. Determine the number of drying times needed, for example short condition 4 minutes, medium condition 8 minutes, full dry 18 minutes. To these times, add a minimum of 0.5 minutes for tumbler load and unload and any time given to cool down after full dry.

b. Calculate the number of loads for each drying time for example:

618 loads short dry @ 4.5 min	=	46.4 hr
314 loads medium dry @ 8.5 min	=	44.5 hr
152 loads long dry @ 18.5 min	=	46.9 hr
	=	137.8 hr

Divide by tunnel hours (33.15 hr)

= 4.15

c. Therefore 4 or 5 tumblers are required.

35. Tunnel loading sequence

The tunnel must be loaded in a sequence which allows continual use without the machine being held up because tumble-driers are unavailable.

a. Examine ratios of loads requiring drying, for example from paragraph 34(a) above, the ratio is approximately 4:2:1. The load sequence must be 4 short dry, 2 medium dry and 1 full dry. If the sequence is broken, "tumbler hold" of the washing machine will occur unless there is excess capacity.

b. Multiply the number of tumblers by the machine cycle time to calculate tumbler availability time:

1.8 min × 4 tumblers	=	7.2 min
1.8 min × 5 tumblers	=	9.0 min

Calculate time of sequence repeated at least 4 or 5 times, for example

Sequence = (4 short – 2 med – 1 full dry) x 5 =

5 × 4 × 4.5 min short	=	90 min
5 × 2 × 8.5 min med	=	85 min
5 × 1 × 18.5 min long	=	92.5 min
35 loads	=	267.5 min
Divide total mins by total loads	=	7.64 min

36. This time of 7.64 minutes is in excess of the tumbler availability for 4 tumblers (7.2 minutes) and therefore will give a tumbler hold to the wash-line. However, the 7.64 minutes is much less than the 9.0 minutes for 5 tumblers and the sequence would then run without a hold. This check is not completely accurate. It does, however, give a good indication and, provided the sequence time is at least one minute less than the available group tumbler time, it is reasonably accurate as an indicator of the number of tumblers required or the consequences of changing a load sequence.

Flat-work preparation

37. Mechanical aids to spreading and feeding are essential to achieve the efficient operation of a high-speed calender on large flat-work production. The several types available include a fan-shaped spreader. This should be used in conjunction with a feeding aid whose action is to remove creases and automatically control the feeding, without further assistance from operators, immediately after the leading edge of the article is placed on the calender feed-bands and held. This feeding aid, which fits closely to the calender and occupies little floor space, may rely on suction fans for its operation or upon mechanical means of spreading and tensioning.

38. Another type, which has been developed to contribute towards higher feeding rates, provides for the spreading of large pieces of flat-work which are fed alternately by operators stationed at both sides of the feeding machines or by two operators stationed in front of the feeding machine. The machine includes automatic transfer from the spreading unit to the ironing feed-bands.

39. Flat articles, other than large ones, will need to be dealt with on a separate ironing machine in the larger laundries and should be prepared for feeding at high speed. If a high-speed machine is used for calendering smaller flat articles, ample space should be provided next to the ironing machine for the necessary preparation. It can be advantageous to install special preparation equipment for small articles in some cases.

Flat-work ironing machines

40. Although the basic design of flat-work ironing machines has not changed in recent years, minor developments have contributed to more effective heat transfer and greater throughput. A calender which irons and dries 800 sheets per hour with an initial moisture content of 40% of the dried weight liberates 270 kg of water vapour per hour. This adds to ventilation problems, particularly during hot weather. Therefore preference should be given to calenders which are fitted with ventilated rollers and extract fans which permit a large proportion of this moisture to be vented directly to the outside atmosphere.

41. Steam has always been the principal heating medium for these machines but it may be superseded by heat transfer fluids at temperatures appreciably higher than that of steam at 7 bar g. For a given throughput, fluid-heated machines would be smaller and should cost less than steam-heated machines. The use of liquid phase heating at present indicates that under certain circumstances it could be a viable alternative to the use of steam.

42. The labour content for the preparation of small flat-work for feeding into flat-work ironers continues to be high because no great advance has been made in the mechanisation of this type of work. Ideally, the flat-work load of a laundry should be sufficient to keep flat-work ironing machines employed at optimum throughput during the whole working week. In cases where the capacity of a multiple-roll ironing machine becomes insufficient to meet increasing demand, the installation of a small individual single-operator finishing unit can be more economic than the provision of a further multiple-roll flat-work ironing machine, which would in turn involve poor utilisation of another team of operators. Full advantage should be taken of any developments of mechanised preparation, feeding, folding and stacking equipment associated with flat-work ironing where these

can be shown by total cost techniques to reduce production costs materially.

43. In recent years deep-bed machines of unit construction have been an outstanding feature of laundry machinery development. The rolls are usually about 800 mm in diameter, and since they are not capable of floating (lifting) to the extent possible on earlier machines with smaller rollers, spring padding is usually fitted. The deep-bed type of machine is reliable and efficient, combining good output, high quality production and minimum space requirements. Consideration of other types of ironing machines or alternative heating mediums mentioned in paragraphs 40 and 41 should not, however, be excluded provided they are equally suitable and efficient. Heat emission from these machines can be considerable, and to assist comfortable working conditions there should be efficient lagging of beds, gap pieces, steam and condensate pipes and fittings. Calender hoods should be fitted wherever possible.

44. The evaporative performance of a modern 4-roll ironer with 800 mm diameter rolls at 150 psi is well in excess of 1000 sheets per hour. However, there are limiting factors in terms of the speed of feed and the quality required. A good average is likely to be in the order of 800–900 sheets per hour.

45. In every instance the evaporative capacity of tumble-driers should be known and the work for the ironer conditioned to a level that the ironer can remove. Excessive conditioning uses tumbler steam and tumbler capacity wastefully.

46. With a modern ironer and fabrics, for example polyester cotton, it is likely that the flat-work will not require conditioning. 100% polyester sheets require the retention of high moisture levels (55%) if they are to be fed through 4-roll calenders, otherwise static will develop and make them difficult to fold. Ideally they should finish slightly damp to avoid the development of static. Usually they will dry from the heat of the stacked sheets and from the warmth in storage.

Flat-work folding machines

47. For efficient operation of flat-work ironing machines, automatic folding equipment is essential. There are two principal types of flat-work folding machines. The first produces lateral folds and can be suitable for folding a single lane of large flat-work or a number of lanes of small flat-work. Some designs provide for switching from single-lane operation to any combination of the multiple lanes, thus permitting the machine to handle various widths of flat-work. The second type produces cross folds and is coupled to the first type, thus enabling the entire folding operation to be completely automatic.

48. Where folders are used, it will be necessary to examine large articles for rejection or repair either during preparation, or whilst feeding the calender. A fingertip control fitted at the feeding end of the calender will enable a substandard article to bypass the folding mechanism at the other end. Normally it will be possible to reject substandard small flat-work during its preparation.

49. Because of the difference in the make-up of articles between laundries, the folding equipment specified in Appendix 2 should be regarded as a guide only. In some instances the specialisation of flat-work flow-lines may warrant the use of stacking machines. For a particular laundry, details of the number and size of flat-work articles to be dealt with on folding machines should be established so that the mechanical folding requirements may be specified to meet the particular needs of any user.

Drying plant

50. The processes of complete drying are now carried out by tumble-driers. Although static drying plant, which was at one time widely used, may be more satisfactory for woollen articles because of the reduced risk of shrinkage, it should not now be used owing to the amount of space which it occupies and the labour needed to handle individual articles. Shrink-resistant materials will withstand tumble-drying more satisfactorily than untreated materials and the case for static dryers is not a strong one. A possible exception is the use of small heated cabinets for drying a limited quality of drip-dry garments in the special section dealing with patients' personal clothing. The use of cellular cotton blankets has resulted in considerable reduction in the amount of woollen articles requiring laundering, but where the use of woollen blankets is preferred, reference should be made to the Joint Report of the Wool Secretariat and the British Laundry Research Association 'High temperature laundering of hospital woollen blankets' (1959). It is important to ensure that tumble-driers intended for articles other than cotton are thermostatically controlled two-speed machines which will permit woollens and other textiles prone to shrinkage to be dried at temperatures lower than those permitted for cotton, and with less mechanical action. Where continuous process washing plant is employed, conditioning tumblers form part of an integrated flow-line.

51. Conventional end-loading tumble-driers designated for manual loading and unloading, are suitable for handling loads of up to 45 kg. For larger loads, self-loading and unloading tumblers which practically eliminate labour are more economic.

52. Tumblers should be positioned so that operators engaged on folding fully dried articles can deal with them immediately the tumbler is unloaded. By so doing, the risk of spontaneous ignition will be eliminated. Undesirable creasing will be minimised and the quality improved. There

is a very real fire risk from bulk loads of hot dried work, and tumblers designed for cooling hot loads of dried cotton articles are preferred. There is a special need for a cooling cycle on tumblers used for synthetic fabrics.

53. Provided there are sufficient quantities (1000 or more per hour) of standardised articles such as towels and blankets, the use of a mechanical folding and stacking machine for tumble-dried work can be economic. Such machines can sometimes be used with advantage to fold small standardised articles which have been calendered. Their use cannot be justified unless there are sufficiently large quantities and there is a high degree of standardisation of article size and weight.

Garment finishing machines

54. There has been considerable development in the production of man-made fibres and no doubt this will continue in future. This should be kept in mind when planning the garment finishing department of any laundry. Before reaching any decision on finishing equipment, it is advisable to make a careful study of the style and material of the garments to be handled and the quality of finish that is acceptable.

55. The use of mixture materials such as 65/35% polyester/cotton and 100% polyester for protective clothing and uniforms, and the improved finishing methods for garments made from these materials can result in considerable savings in finishing costs. It should be borne in mind that general manufacturing techniques have a very important bearing on successful results from the use of special finishing equipment for garments made of these materials.

56. One of the finishing methods is the steam/air finishing tunnel which has a high productivity per operator, but the machine size and speed must be sufficient for the number and type of materials being processed. Another method is the use of specialised steam/air form finishers, but the limitations imposed by the size and shape of the forms and their associated expanders must be kept in mind. The production per operator from these special finishers will not be as great as that obtained from the steam/air tunnel but it will be considerably more than attained by the use of pressing machines.

57. Satisfactory results from these machines will depend mainly on a combined solution of all problems presented by the factors mentioned in paragraphs 2.19 to 2.23 and the washing processes employed, but the machines must be capable of processing the garments to provide a general appearance and surface finish appropriate for their particular use. By their nature, steam/air finishing units liberate appreciable quantities of heat and water vapour. To ensure working conditions of reasonable comfort a properly designed hood and extraction fan capable of conducting excessive heat and moisture to the outside air should be provided when these units are installed.

58. The steam/air finishing tunnel conveys garments continuously on hangers through a steaming chamber which relaxes the fabric and then through a drying chamber in which hot air is circulated a high velocity. It may be necessary for garments to be conditioned in a tumble-drier before passing them through the finishing machine, otherwise proper drying of multiple thickness of pockets, cuffs, lapels and hems may no take place because of high production rates. The garment former presses single garments on a form provided with expanders which tension the garment prior to steaming and subsequent drying by hot air.

59. The introduction of blended fabrics, which are ideally suited to tunnel finishing, has led to a reduction in the use of the rotary presses. However, they have been included to cater for those materials still requiring pressing.

60. Pressing machines will be required for finishing garments made from natural fibre materials and where a high grade of finish is required. Production rates from presses, although lower than those from the other two methods, can be maintained at a reasonable level provided the garments are designed to permit a series of easy and straightforward lays on the buck of a rotary or scissors-type press or on the expanding form of a cabinet unit. Special care must be exercised to minimise the tendency to glaze garments in the locality of seams or multiple thicknesses. Where a large number of patients' personal clothing articles are being dealt with, a trouser cabinet press should be considered.

61. Where the amount of small flat-work to be processed is greater than the capacity of one or more calenders but the excess does not warrant the provision of an additional calender, pillowcases and other flat-work of similar size may be finished on a continuous small-work pressing machine. These pressing machines permit both preparation and feeding by one operator and can incorporate an auxiliary folding and stacking unit.

62. All types of finishing machine need to be properly insulated in order to minimise heat radiation.

Conveyors

63. Conveyors are sometimes needed for transportation of work between washing plant, conditioning plant, flat-work ironers and tumble-driers. A conveyor system for the tunnel finisher is essential for storage of sorted garments which are then ready for dispatch.

Appendix 2

Schedule of plant

Laundry

The following is a guide to the main items of plant required for the work mix given in paragraph 2.30 and an average dry weight of 0.432 kg per article. This Appendix should be carefully studied to enable the choice of plant and equipment to be matched with the make-up of the workload, average weight per article and the proportion of infected work to be processed.

Items of plant required

Laundry capacity				
Articles weekly	55,000	100,000	150,000	200,000
Dry weight @ 0.432 kg per article ± 0.02 kg	23,760 kg	43,200 kg	64,800 kg	86,400 kg
	Number of items			
General wash				
continuous batch washing machine with membrane press – 36 kg	5–8 stage	5–13 stage	5–20 stage	5–18 stage 5–9 stage
Washer-extractor, capacity 90 kg	–	1	2	3
Washer-extractor, capacity 45 kg	3	2	2	2
Infected wash				
Washer-extractor, capacity 60 kg	–	–	–	1
Washer-extractor, capacity 45 kg	1	2	3	2
Tumblers				
Continuous auto tumblers matched with continuous batch washing machine	3	5	6	5 4
Batch independent 60 kg	–	–	1	–
45 kg	1	3	2	4
Calenders				
4–roll 800 mm × 3000 mm	1	2	3	4
Calender feeding equipment				
Automatic feeder for large flat-work	1 × 3 station	2 × 4 station	2 × 4 station	2 × 4 station
Calender folding equipment				
Universal 3-lane	1	–	–	–
4-lane	–	2	–	1
4-lane Stac-n-fold	–	1	1	1
2-lane	–	–	2	2
Stac-n-fold	–	1	1	–
Stac-n-count	–	–	2	3
4-lane Stac-n-count	–	–	–	1
Multipurpose	–	–	1	1
Tunnel finisher				
300 items per hour	1	–	–	–
550 items per hour	–	1	–	–
814 items per hour	–	–	1	–
1100 items per hour	–	–	–	1
Pressing				
Rotary press	1	2	3	4
Hoffman press	1	1	1	1

Other equipment

Other equipment required is set out below:

Sorting room

Weighing machine;

Slat or step conveyor to feed tunnel washer. This will be either "horizontal", or "elevated". Alternatively, a monorail bag system with facilities to store classified work, to be called off by microprocessor in the required sequence for delivery to the tunnel washer.

Washroom

Automatic controls for all washer-extractors with associated storage tanks for detergent and other material solutions;

Synchronising equipment for tunnel wash-lines and suitable means of automatically feeding the tunnel washer with the required materials;

Membrane press for moisture removal after washing in the tunnel wash machine;

Shuttle conveyor to feed work from the membrane press to the auto tumblers;

Heat and water recovery equipment including calorifiers and hot water storage vessels.

Tunnel finishers and tumblers

Heat recovery or re-circulation;

Humidity sensors to determine selected drying points.

General

Air compressors, trolleys, racks etc.

Appendix 3

Dry-cleaning equipment

Dry-cleaning machines of the non-flammable type equipped with automatic control are recommended. Their range of sizes makes it possible to design dry-cleaning units which can operate economically for the workloads detailed in this Appendix. New developments in dry-cleaning machines have provided what is termed a "dual phase" machine which incorporates wash sequence prior to the dry-cleaning cycle. This machine must be carefully evaluated before any decision is made to incorporate it in a dry-cleaning unit. When selecting dry-cleaning machines the general requirements of Appendix A, paragraph 2 are applicable.

Dry-cleaning capacity			
Dry weight weekly (kg)	600	800	1100
Dry-cleaning machine capacity per load(kg)	12	16	22
Dry-cleaning machine (non-flammable)	1	1	1
Garment presses	2	2	3
Steam/air form finisher	1	1	2
Spotting table	1	1	1
Air vacuum unit	1	1	1

Other equipment

Weighing facilities;
Simple "slick rails" for support and transfer of garments on hangers;
Solvent storage tank.

Notes:

1. Capacities are based on a 40-minute process including load and unload @ 85% utilisation of capacity.
2. Garment presses are of the manually-operated type with free steam and vacuum facilities.
3. Steam/air form finishers are of the simple non-cabinet type and with fabric forms.
4. The solvent storage tank will normally be installed outside the building with easy access for filling from bulk supply vehicles.

Appendix 4

Special personal clothing section – schedule of plant

Special personal clothing capacity – articles per week	3,000–3,500	4,500–5,000	6,000–7,000	12,000–14,000
Washer-extractor 6 kg capacity	–	1	1	–
Washer-extractor 12 kg capacity	2	2	1	1
Washer-extractor 18/20 kg capacity	–	1	2	2
Washer-extractor 25/30 kg capacity	–	–	–	2
Tumble-drier 14.15 kg capacity	1	2	2	2
Tumble-drier 20/25 kg capacity	–	–	–	2
Rotary garment press	–	–	1	1
Steam/air tunnel finisher	1	1	1	1

Notes:

1. The washer-extractors should have automatic and thermostatic control, should be capable of reaching thermal disinfection temperatures, and be capable of a pre-sluicing function for processing fouled articles.
2. The tumble-driers should have thermostatic control and automatic cool-down

Other equipment (depending on size of section)

Flat belt conveyor;

Soiled work classifier;

Stainless steel sink(s) and draining board(s)
Spin drier/small hydro extractor
} For stain removal purposes;

Hand iron and ironing board;

Packing table(s);

Weighing facilities;

Containers for soiled clothing;

Work trolleys;

Compartment racks;

Mobile garment rails.

Appendix 5

Service requirements

The table below is a guide to consumption of steam, water and electricity to be assumed for the four sizes of laundry scheduled. This has been based on the plant and equipment given in Appendix 2. The final estimates of service consumption must relate to the type of equipment ultimately selected to suit the particular laundry load and its work mix. Laundries with large volumes of flat-work will have less need than those with high volumes of more general work.

Laundry capacity				
Articles weekly (pieces)	55,000	100,000	150,000	200,000
Dry weight (@ 0.432 kg ± 0.2 kg)	23,760 kg	43,200 kg	64,800 kg	86,400 kg
Steam (approx. hourly consumption (kg))				
Tunnel washer installation				
High pressure	1,500	2,800	3,900	5,200
Low pressure	435	770	1,100	1,500
Alternative W/E installation				
High pressure	1,500	2,800	–	–
Low pressure	615	1,100	–	–
Water (approx. hourly consumption (litres))				
Tunnel washer installation				
Cold 65%	6,800	12,400	18,500	24,200
Hot 35%	1,200	2,200	3,300	3,500
Alternative W/E installation				
Cold	8,900	16,200	–	–
Hot	4,800	8,700	–	–
Electricity (units per hour (kWh))				
Tunnel washer installation (approx. 100–110 units per 100 kg dry weight)	67	122	166	221
Alternative W/E installation (approx. 120 units per 100 kg dry weight)	73	133	199	266

Notes:

1. The steam, water and electricity consumption compares the differences in these services to the batch continuous tunnel washing system, and to the washer-extractor system where appropriate.

Steam

1. Low-pressure steam for the washroom should be at approximately 3–5 bar to avoid steam penetration through the surface of the water and venting to atmosphere. This recommendation can be varied at the request of manufacturers who are installing specialised plant.
2. Target figures given for steam consumption could be reduced by 0.3–0.5 kg/kg by the use of heat reclamation systems where appropriate.
3. Incorrect processing procedures can be largely responsible for wastage of energy.
4. Work mix has an effect on steam consumption. Generally, the more varied the workload the higher steam consumption will be.
5. No allowance is given in the figures for heating and ventilation.

Water

1. The figures given for water consumption are substantial and in the case of a completely new laundry an

assessment of water available from the local water authority should be made.

2. The potential for water recovery and re-use has in the main been covered by the use of tunnel wash systems. Reversion to use of washer-extractors either wholly or in part would enhance potential for recovery systems. However, despite the much lower use of water made possible by tunnel washers, new technology for water recycling should be considered whenever available.

3. Heat obtained from waste effluent can be used to preheat cold water.

4. The drainage system should be designed to deal with the effluent from all machines without risk of flooding. Tunnel washers have a low water usage of which 60% is recycled.

5. For washing plant dedicated to processing infected work, the drains from these machines should be sealed to the point where they join the sewer outside the building, and the ventilation pipe of these machines should be taken to external atmosphere or to a covered sump.

6. The formation of lint during washing is unavoidable. Filters on some tunnel washers are standard and on others can be specified. The use of filters on tunnel washers is good practice and reduces the volume passing to the drain. Easily-cleansed filter systems should be considered in the main drain channel to avoid the development of various problems from the collection of lint.

Electricity

1. The laundry is probably the largest user of equipment on site that can influence power factor. Charging for electricity varies between the different electricity boards, some of whom make severe penalties for "power factors" outside their norm. Consideration should be given to the use of capacitors to control power factor, if thought necessary. The capacity of the capacitors should be reviewed whenever new equipment, or replacement equipment with higher electrical demands, is being installed.

2. The figures given for electricity are inclusive of the requirements for heating, lighting and ventilation. The efficiency of tunnel wash systems has been taken into account for this calculation. Reversion to greater use of washer-extractors and batch tumble-driers will increase the target figure.

3. The use of capacitors on individual machines is not cost effective. The best option is to have power factor correction on the factory as a whole concept.

Appendix 6

Energy conservation

General

1. Most steam-heated laundries will generate more excess low-grade heat than can be conveniently re-used due to the characteristics of steam as an energy transfer medium. Therefore the aim of this Appendix is to advise on the conservation of as much of the energy as reasonably practicable. It is important to note that most energy-conservation measures are interdependent. Accordingly the choice of energy-conservation equipment and cost appraisal has to take into account all the relevant factors. Particular attention must be given to the increased maintenance and energy costs. The following guidance is intended to assist in the selection of the most appropriate energy-conservation equipment.

Basic information

2. To determine the best solution for each laundry the following information should be ascertained:

Water
- degree of hardness;
- pressure head and flow rate available;
- supply or extraction fee (artesian wells);
- sewage costs (less discount for evaporation) – any limitations on terms and/or chemical content;
- softening costs.

Electricity
- maximum supply available;
- maximum demand (KVA tariff);
- power factor;
- type of tariff;
- cost.

Steam
- maximum flow rate;
- maximum sustainable pressure;
- dryness fraction.

Condensate
- limitation on returnable temperature;
- amount to be returned.

Wash-house

3. The three main elements to be considered in this section are water, steam and electricity.

4. Water recovery and recycled water, generally rinse water only, are proven means of reducing water usage on washer-extractors. This is inherent in batch continuous tunnel washing systems. Total heat recovery from effluent is a recent innovation and is expected to recover approximately 80% of the water and most of the heat. This system has yet to be proven and indications are that chemical balance in the system is of paramount importance. The payback period is protracted at present but with projected costs for water and effluent charges going up drastically this could make the system viable.

5. Heat recovery from effluent discharge through heat exchangers is now standard practice and can be used on all types of washing machines. Care must be exercised to determine the viability of any composite scheme that may combine tunnel washers with washer-extractors, particularly dedicated washer-extractors used for infected work with their sealed drains. Any recovered hot water should not exceed 38°C where this water is being used for first wash. This will prevent stain setting in the dirty linen. Heat recovery systems are available in various designs with varying efficiencies and running costs (see table).

6. All the above save steam, but flash steam recovery can do so most cost-effectively. This steam can be used to service other washing plant where two or more batch continuous tunnel washing machines are used and storage calorifiers for hot water usage etc. The most cost effective method will have to be assessed at the design stage of any project.

7. Soft-start motors will conserve electricity by preventing high peaks on start-up on machinery. The efficacy of power factor correction should be assessed on individual machines or the factory as a whole to determine the best cost.

Heat exchangers

Type of heat exchange	Typical efficiency range expected (heat recovered from usable effluent)		Typical cost profile		Typical running costs (£/annum)	Expected life-span (years)	Remarks
	Peak (%)	Average (%)	£K	Effluent discharge rate (m^3/hr)			
Coiled stainless steel co-axial tube	90	72	14 17 20	Minimum 10 20	350 400 450	10	Complete with pumps, instruments and controls. 11 sizes availabe in modular form. Collection pit/tanks required. Can be used for all washers with larger collection.
Shell	85	62	15 22 30	Minimum 10 20	325	10	Complete with pumps. Instruments and 4 sizes available to suit scheme. Can be installed without collection, viz. tunnel washers. Pit/tank needed if used with all washers.
Shell and tube	90	74	25 30 34	minimum 10 20	800	10	Can recover effluent from all washing machines. Collection pit/tank necessary.
Plate and filter plus water saving	50	45	17 25 31	minimum 10 20	500/700	10	Potential cross-infection problem. Recovers heat and water pumped at high pressure through filter media. Reduction in detergent usage, water-saving a major item.

Conditioning plant

8. Tumble-driers are potentially the largest energy users in the laundry and there are a number of methods to reduce this usage. These can be incorporated in new equipment or retrofitted on existing tumble-driers. Care will have to be exercised on any retrofit system as these increase the pressure in the exhaust system and thereby reduce flow by as much as 25%. It is possible to overcome this reduction by fitting larger fans, but it may not be practical on some machines.

9. Condense cooling takes the condensate from the steam to the main heater battery. This is allowed to return as condensate through a primary heater battery and then back into the normal condensate return pipework. This method provides an air preheat, but does not reduce the total energy usage. However, it will mitigate any flash steam loss.

10. Re-circulation is used by certain manufacturers where the hot moist air is re-circulated through the tumble-drier before being exhausted to atmosphere. This ensures full moisture saturation of drying air and improves the thermal performance.

11. Cross-flow heat exchangers are currently the most versatile and viable form of energy saving. The tumbler inlet air is drawn through the air passages of the heat exchanger, pre-heating it before it passes through the tumbler heater battery and then into the drying compartment.

12. An end-point detection device monitors the humidity/temperature during the tumble-drying process and effectively finishes the load according to the setting of fully dried, medium conditioned, lightly conditioned etc. The drying cycle is switched off as soon as the required conditions are achieved. It also incorporates a cool-down

device which is very useful in preventing any spontaneous combustion and allows the work to be handled straight away.

13. Gas-fired tumble-driers are now more viable. If gas is on site it is cost effective to use this medium as it reduces the amount of steam usage and tumble-drier requirement. A recent installation demonstrated that for every four steam driers, only three gas-fired driers are required. This technique may be combined with a measure of re-circulation, but care must be taken to avoid local overheating in the process cycle. Judgement must be made on comparisons of capital and revenue costs and of the fabrics to be processed.

Finishing equipment

14. Tunnel finishers have similar attributes to tumble-driers and use the same energy-saving device, which is essentially a cross-flow heat exchanger, as explained above. They are also gas-fired.

15. Calenders are another high energy user in the laundry and calender hoods/canopies serve a useful purpose in reducing radiated heat energy usage, and improving safety. For reduction in energy usage a correctly fitted canopy on a suction roll machine has shown savings, but this varies from machine to machine. Instead of steam-heated calenders, thermal fluid is an option allowing operational and capital cost savings, but as mentioned in Appendix 1 (paragraph 41) the operational temperatures are critical. This medium is not suitable for many laundries; typically its employment would be for large flat-work laundries, with minimal workload of shaped garments, finishing, or small washing machines.

Electrical

16. Trials have been carried out on individual machinery and the laundry as a whole on the efficacy of power factor correction. The report states that while it is effective to have power correction on individual poor power factor machines, the most cost effective method is to have a stepped power factor correction on the whole factory.

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Dept of Health publications not published by HMSO are available from the DHSS Health Publications Unit, No 2 Site, Manchester Road, Heywood, Lancs OL10 2PZ. Tel 0706 366287 ext 60209.

Please note that the British Laundry Research Association has now become:

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